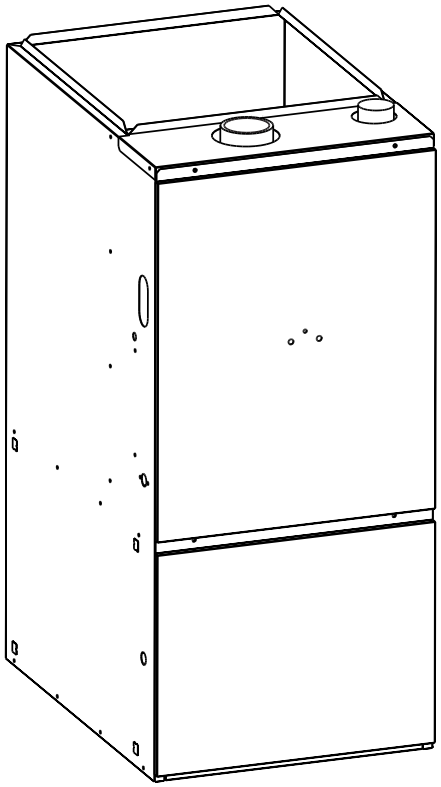
Gas Fired Central Furnaces

Installation Instructions

***TE Series 95+ Upflow/Horizontal Two-Stage Furnace for iQDrive® Systems**



95+
iQDrive®
Upflow/Horizontal Furnace

NOTE: This furnace must be installed by qualified installers who are specially trained on the NORDYNE iQ DRIVE™ SYSTEM.

⚠ WARNING:

Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual for assistance. For additional information consult a qualified installer, service agency, or the gas supplier.

These instructions are primarily intended to assist qualified individuals experienced in the proper installation of this appliance. Some local codes require licensed installation/service personnel for this type of equipment. Read all instructions carefully before starting the installation.

DO NOT DESTROY. PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.

⚠ FOR YOUR SAFETY:

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

⚠ FOR YOUR SAFETY:

WHAT TO DO IF YOU SMELL GAS:

- **Do not try to light any appliance.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**
- **Extinguish any open flame.**

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FURNACE SPECIFICATIONS

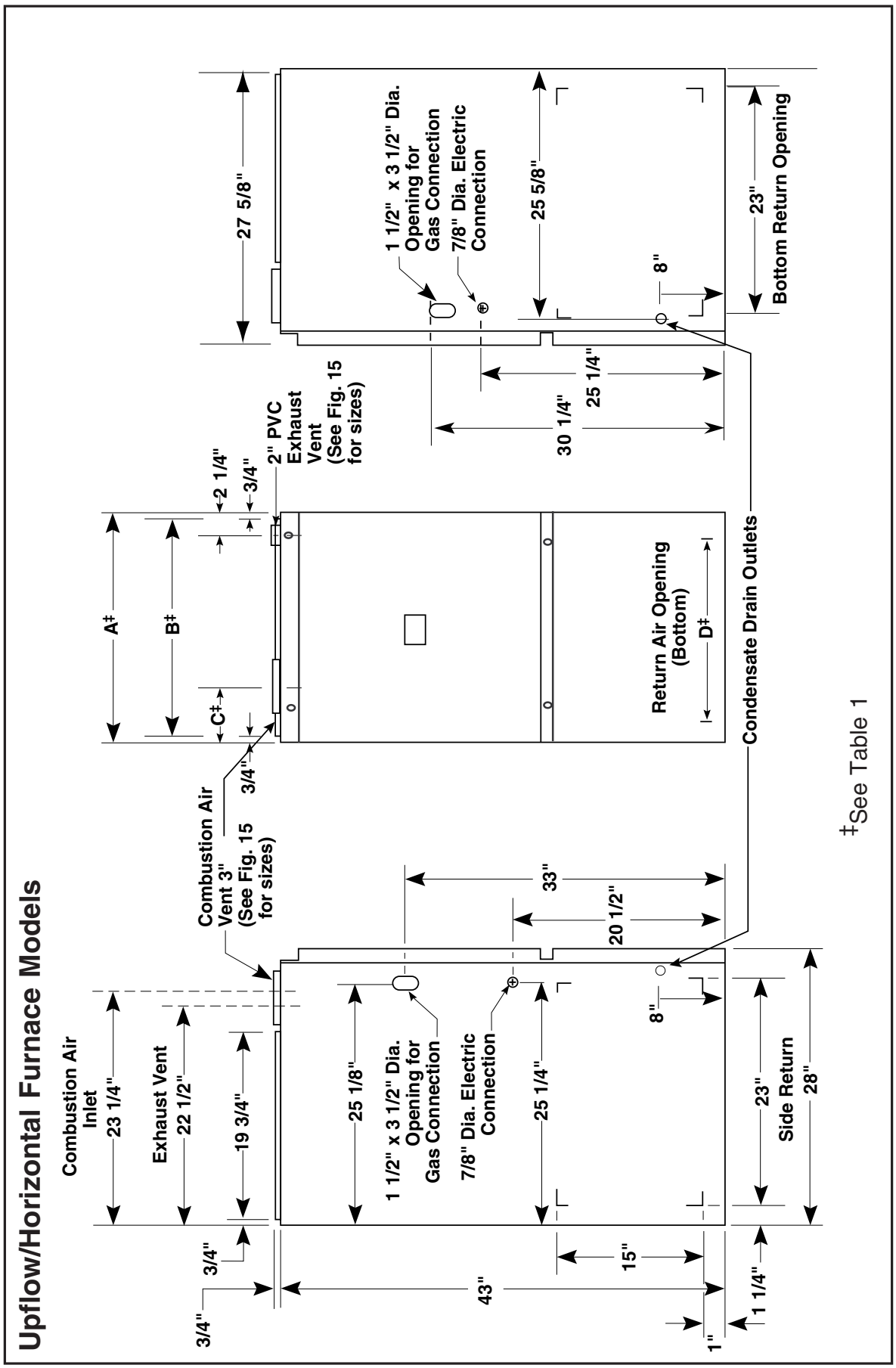


Figure 1. Upflow/Horizontal Unit Dimensions

SAFETY INFORMATION

1. Use only with type of gas approved for this furnace. Refer to the furnace rating plate.
2. Install this furnace only in a location and position as specified on Tables 1 and 2 of these instructions.
3. Provide adequate combustion and ventilation air to the furnace space as specified on Pages 10 through 14.
4. Provisions for adequate clearances around the vent air intake terminal(s) as specified on Figures 13 through 17 of these instructions.
5. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified on Pages 14 through 22.
6. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified on Page 25 of these instructions.
7. Always install furnace to operate within the furnace's intended temperature-rise range with a duct system which has an external static pressure within the allowable range, see furnace rating plate.
8. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.
9. A gas-fired furnace for installation in a residential garage must be installed as specified on Page 7 of these instructions.
10. The furnace is not to be used for temporary heating of buildings or structures under construction.

INSTALLATION REQUIREMENTS

Requirements and Codes

This furnace must be installed in accordance with these instructions, all applicable local building codes, and the current revision of the National Fuel Gas Code (ANSI-Z223.1, NFPA-54). The current revision of the National Fuel Gas Code is available from:

American National Standards Institute, Inc.
1430 Broadway
New York, New York 10018

Canada installations shall comply with CAN/CGA-B149 installation codes, local plumbing or waste water codes and other applicable codes. Additional helpful publications are:

- NFPA-90A - Installation of Air Conditioning and Ventilating Systems.
- NFPA-90B - Warm Air Heating and Air Conditioning Systems.

These publications are available from:

National Fire Protection Association, Inc.
Batterymarch Park
Quincy, Massachusetts 02269

WARNING:

This furnace is not approved for installation in mobile homes. Installation in a mobile home could cause fire, property damage, and/or personal injury.

Model Number	High Fire Furnac	Low Fire Furnac	Temperature Rise Range, °F		Dimensions (inches)				Shipping Weight (lbs)
			1st Stage	2nd Stage	A	B	C	D	
*TE060	60,000	42,000	35-65	35-65	19 3/4	18 1/4	7 7/8	17 1/4	195
*TE080	80,000	56,000	30-60	30-60	19 3/4	18 1/4	7 7/8	17 1/4	195
*TE100	100,000	70,000	40-70	40-70	19 3/4	18 1/4	7 7/8	17 1/4	200
*TE120	120,000	84,000	45-70	45-75	22 1/2	21	9 1/4	20	220

Table 1. Furnace Dimensions and Shipping Weights

IMPORTANT NOTE

The Commonwealth of Massachusetts requires compliance with regulation 248 CMR 4.00 and 5.00 for installation of through – the – wall vented gas appliances as follows:

(a) For direct-vent appliances, mechanical-vent heating appliances or domestic hot water equipment, where the bottom of the vent terminal and the air intake is installed below four feet above grade the following requirements must be satisfied:

1. If there is not one already present, on each floor level where there are bedroom(s), a carbon monoxide detector and alarm shall be placed in the living area outside the bedroom(s). The carbon monoxide detector shall comply with NFPA 720 (2005 Edition).

2. A carbon monoxide detector shall be located in the room that houses the appliance or equipment and shall:

   a. Be powered by the same electrical circuit as the appliance or equipment such that only one service switch services both the appliance and the carbon monoxide detector;
   b. Have battery back-up power;
   c. Meet ANSI/UL 2034 Standards and comply with NFPA 720 (2005 Edition); and
   d. Have been approved and listed by a Nationally Recognized Testing Laboratory as recognized under 527 CMR.

3. A Product-approved vent terminal must be used, and if applicable, a Product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.

4. A metal or plastic identification plate shall be mounted at the exterior of the building, four feet directly above the location of vent terminal. The plate shall be of sufficient size to be easily read from a distance of eight feet away, and read "Gas Vent Directly Below".

(b) For direct-vent appliances, mechanical-vent heating appliances or domestic hot water equipment where the bottom of the vent terminal and the air intake is installed above four feet above grade the following requirements must be satisfied:

1. If there is not one already present, on each floor level where there are bedroom(s), a carbon monoxide detector and alarm shall be placed in the living area outside the bedroom(s). The

CLEARANCES TO COMBUSTIBLE MATERIALS

This furnace is Designed Certified by CSA International for the minimum clearances to combustible material listed in Table 6. See the furnace name plate, located inside the furnace cabinet, for specific model number and clearance information.

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIAL						
High Fire Rated Input (Btuh)	Cabinet Width (Inches)	Minimum Clearances (Inches)				
		Side	Vent	Back	Top	Front
60,000	19 3/4	0	0	0	1	1‡
80,000	19 3/4	0	0	0	1	1‡
100,000	19 3/4	0	0	0	1	1‡
120,000	22 1/2	0	0	0	1	1‡

‡ 24 inches is the minimum clearance for servicing.
36 inches is the recommended clearance for service.

Table 2. Minimum Clearances to Combustible Materials

carbon monoxide detector shall comply with NFPA 720 (2005 Edition).

2. A carbon monoxide detector shall:

   a. Be located in the room that houses the appliance or equipment;
   b. Be either hard-wired or battery powered or both; and
   c. Shall comply with NFPA 720 (2005 Edition).

3. A Product-approved vent terminal must be used, and if applicable, a Product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.

Location

The furnace must be installed on a level surface, and as close to the center of the air distribution system as possible. See Table 1 for overall dimensions to determine the required clearances in hallways, doorways, stairs, etc. to allow the furnace to be moved to the installation point. The furnace must be installed so that all electrical components are protected from water.

Minimum clearances to combustible materials are listed in Table 2. Access for positioning and servicing must be considered when locating the unit. 24 inches is the minimum required clearance for servicing the unit. 30 inches is the minimum required clearance for positioning the unit. 36 inches is the recommended clearance from the front of the unit. Please note that a panel or door can be located such that the minimum clearance on the rating plate is satisfied, but that panel or door must be removable so as to allow the appropriate clearance.

This furnace is certified for use on wood flooring. The furnace must be installed on a solid surface and must be level front to back and side to side. This furnace must not be installed directly on carpeting, tile, or any combustible material other than wood flooring.

A gas-fired furnace installed in a residential garage must be installed so that the bottom of the furnace is located a minimum of 18" from the floor. The furnace must be located or protected to avoid physical damage by vehicles.

HORIZONTAL INSTALLATIONS

The upflow model furnaces are approved for horizontal installation. Installation Kit #903568 is available for horizontal applications. The parts may also be field supplied. The parts that are field supplied should conform to Figures 2 and 3.

⚠ CAUTION:

Damage to the product resulting from failure to follow instructions or use of unauthorized parts may void the manufacturer's product warranty coverage.

The 90+ upflow furnace can be installed horizontally in an attic, basement, crawl space or alcove. This furnace can be installed horizontally to the clearances listed in Table 6 on a platform or on the ceiling rafters. Note that the platform and the ceiling rafters must be able to support the weight of the furnace being installed. It can also be suspended from a ceiling in a basement or utility room in either a right to left airflow or left to right airflow.

When installed horizontally, the furnace must be raised above the surface to allow a drain trap to hang vertically below the furnace. This will allow for proper drainage of the condensate from the furnace.

Conversion of the iQ Drive Upflow Furnace for a Horizontal Right Installation.

Refer to Figure 2.

1. Remove the hard "J" tube drain trap assembly.
2. Place the 5/8" cap plug over the drain trap in the header box from which the "J" drain trap assembly was removed.
3. Remove the piece of soft tubing running from the in-line drain assembly to the header box and place a ½" vinyl cap over the drain tap in the in-line drain assembly.
4. Remove the gray tubing from the pressure tap on the header box. Remove the ¼" cap from the pressure tap on the right side of the header box and place it on the corresponding pressure tap on the opposite of the header box.
5. Place the gray tubing that was removed, to the corresponding pressure tap on the right side of the header box. (Refer to Figure 2)

6. If field supplied parts are used, disconnect both soft tubes from the hard “J” tube drain trap after loosing 7/8" clamps. Shorten long side of the “J” trap by 8-1/2".
7. Feed the 10" piece of soft tubing through the round hole located in the right side of the cabinet wrapper Note: A downward slope must be maintained on the tube as it is routed through the furnace (when the furnace is in the horizontal position).
8. Assemble the 10" piece of soft tube to 5" tall end of the hard (J) tube to the end of the 10" soft tube located outside of the furnace. Secure the connection using one of the clamps that was removed, from the “J” trap. Secure the connection with the 7/8” hose clamp.
9. Reassemble the 30" piece of soft tubing removed from the factory installed “J” tube drain trap to the 2’ tall end of the modified “J” tube drain trap.

Note: Ensure the clamps in step 7 and 8 are securely tightened in order to avoid any condensate leakage.

Note: PVC “T” drain assembly must be installed so that condensate does not get into the induced draft blower.(refer to Figure 2).

Note: To avoid condensate freezing in the drain trap assembly and tubing, insulate around the drain trap assembly and all tubing located in unconditioned space.

Conversion of the *TE Upflow Furnace for a Horizontal Left Installation.

Refer to Figure 3.

1. Remove the hard “J” tube drain trap assembly.
2. If field supplied parts are used, disconnect both soft tubes from the hard “J” tube drain trap after loosing 7/8" clamps. Shorten long side of the “J” trap by 8-1/2".
3. Feed the 10" piece of soft tubing through the round hole located in the left side of the cabinet wrapper. Note: A downward slope must be maintained on the tube as it is routed through the furnace (when the furnace is in the horizontal position).
4. Assemble the 5" tall end of the hard “J” tube to the end of the 10" soft tube located outside of the furnace. Secure the connection using one of the 7/8" hose clamps that were removed from the “J” trap.
5. Assemble the 30" piece of soft tubing that was removed from the “J” trap o the 2" tall end of the modified “J” drain trap. Secure the connection with the 7/8" hose clamp.

NOTE: To avoid condensate freezing in the drain trap assembly and tubing, insulate around the drain trap assembly and all tubing located in unconditioned space.

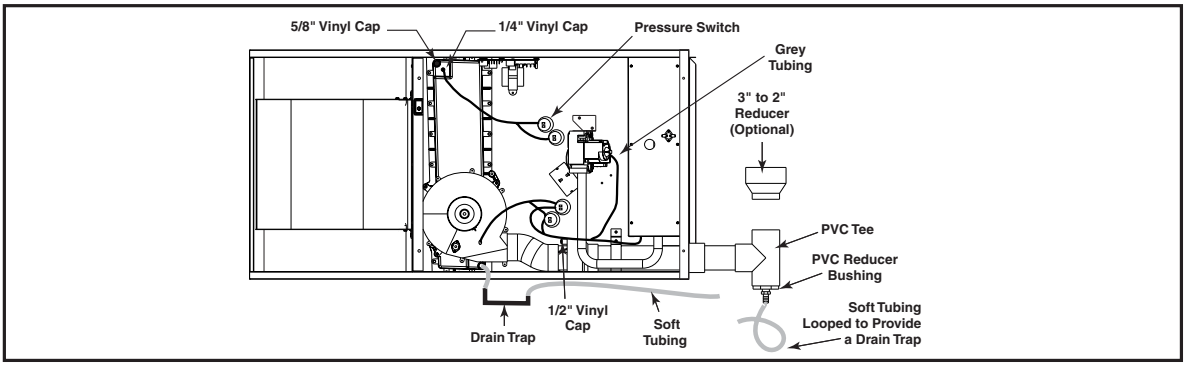
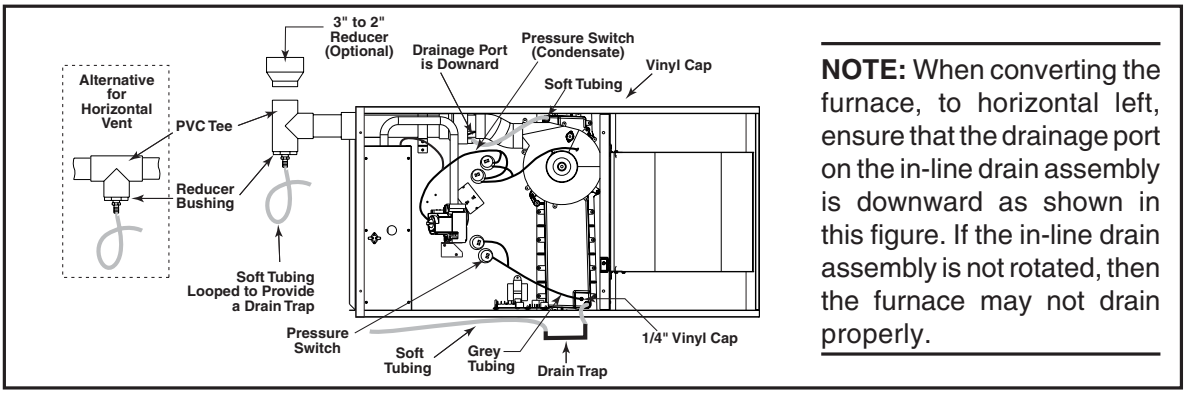


Figure 2. 90+ Upflow Converted for Horizontal Installation (Horizontal Right)



NOTE: When converting the furnace, to horizontal left, ensure that the drainage port on the in-line drain assembly is downward as shown in this figure. If the in-line drain assembly is not rotated, then the furnace may not drain properly.

Figure 3. 90+ Upflow Converted for Horizontal Installation (Horizontal Left)

CIRCULATING AIR SUPPLY

Plenums and air ducts must be installed in accordance with the Standard for the Installation of Air Conditioning and Ventilating Systems (NFPA No. 90A) or the Standard for the Installation of Warm Air Heating and Air Conditioning Systems (NFPA No. 90B).

If outside air is utilized as return air to the furnace for ventilation or to improve indoor air quality, the system must be designed so that the return air to the furnace is not less than 50°F (10°C) during heating operation. If a combination of indoor and outdoor air is used, the ducts and damper system must be designed so that the return air supply to the furnace is equal to the return air supply under normal, indoor return air applications.

When a cooling system is installed which uses the furnace blower to provide airflow over the indoor coil, the coil must be installed downstream (on the outlet side) or in parallel with the furnace.

If a cooling system is installed in parallel with the furnace, a damper must be installed to prevent chilled air from entering the furnace and condensing on the heat exchanger. If a manually operated damper is installed, it must be designed so that operation of the furnace is prevented when the damper is in the cooling position and operation of the cooling system is prevented when the damper is in the heating position.

Return Air

The return air ductwork may be connected to any or all of the following: left side return, right side return, or bottom return. **Where maximum airflow is 1800 CFM or more two openings must be used.**

Determining Nominal AC System Capacity

In order to select the appropriate airflow for AC operation the nominal system capacity must be known. The nominal system capacity is

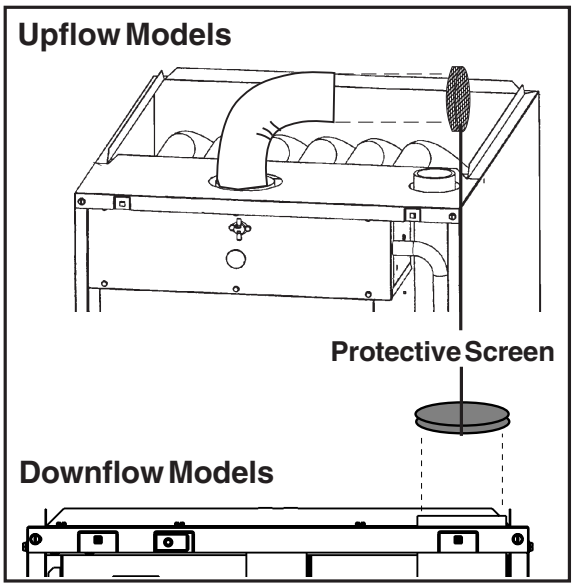


Figure 4. Protective Screen for One Pipe Installations

⚠ WARNING:

Products of combustion must not be allowed to enter the return air ductwork or the circulating air supply. Failure to prevent products of combustion from being circulated into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

All return ductwork must be secured to the furnace with sheet metal screws. For installations in confined spaces, all return ductwork must be adequately sealed and joints must be taped. When return air is provided through the bottom of the furnace, the joint between the furnace and the return air plenum must be sealed.

The floor or platform on which the furnace is mounted must provide sound physical support of the furnace with no gaps, cracks, or sagging between the furnace and the floor or platform.

Return air and circulating air ductwork must not be connected to any other heat producing device such as a fireplace insert, stove, etc.

ALWAYS the nominal capacity of the outdoor unit. In some cases the nominal system capacity is not the same as the nominal capacity of the indoor coil.

Selecting the AC Cooling Airflow

A/C cooling is referred to in the User's manual of the IQ Drive Programmable thermostat.

Selecting the Heating Airflow

Furnace temperature rise depends on airflows rate. To select the air flow, enter the programming screen on the IQ thermostat. Select the furnace input rate and then select the desired temperature rise (see Table 1).

NOTE: To set too high temperature rise of the furnace may result in air limit operation.

VENTING AND COMBUSTION AIR REQUIREMENTS

These condensing furnaces may be installed with outdoor combustion air piped directly to the furnace, or without such special piping. Codes refer to the former as "direct vent" or "two pipe" installation. Installation with air taken from around the furnace is sometimes referred to as "one pipe" installation - i.e. only the vent (exhaust) pipe is provided.

Provisions must be made for adequate supply of air for combustion and ventilation. For United States installations, the adequacy of air provisions can be determined by consulting the current version of the National Fuel Gas Code (ANSI Z223.1/NPFA-54). For Canadian installations, requirements are specified in the National Standard of Canada (CAN/CGA B149.1 & .2). Consult local codes for special requirements.

An important consideration in selecting one or two pipe installation is the quality of the combustion air. Indoor air is sometimes contaminated with various household chemicals which can cause severe corrosion in the furnace combustion system.

NOTE: If the furnace is operated without adequate air for combustion and ventilation, it may not perform properly. Furnace components may be strained by high temperature and could fail prematurely.

⚠ WARNING:

Furnace installation using methods other than those described in the following sections must comply with the National Fuel Gas Code and all applicable local codes to provide sufficient combustion air for the furnace.

Combustion Air Quality

The recommended source of combustion air is to use the outdoor air supply. However, the use of indoor air in most applications is acceptable except as follows:

1. If the furnace is installed in a confined space it is recommended that the necessary combustion air come from the outdoors by way of attic, crawl space, air duct, or direct opening.
2. If outdoor combustion air is used, there must be no exposure to the installations or substances listed in Item 3 below.
3. The following types of installation may require **Outdoor Air** for combustion, due to chemical exposures:
   - Commercial buildings
   - Buildings with indoor pools
   - Furnaces installed in laundry rooms
   - Furnaces installed in hobby or craft rooms
   - Furnaces installed near chemical storage areas

   Exposure to the following substances in the combustion air supply may also require **Outdoor Air** for combustion:
   - Permanent wave solutions
   - Chlorinated waxes and cleaners
   - Chlorine based swimming pool chemicals
   - Water softening chemicals
   - De-icing salts or chemicals
   - Carbon tetrachloride
   - Halogen type refrigerants
   - Cleaning solvents (such as perchloroethylene)
   - Printing inks, paint removers, varnishes, etc.
   - Hydrochloric acid

- Cements and glues
- Antistatic fabric softeners for clothes dryers
- Masonry acid washing materials

Air Requirements For One-Pipe Installation

When air for combustion is to be taken from around the furnace, a protective screen must be installed over the combustion air intake opening. This screen is provided with the furnace installation instructions and functions to prevent debris from entering the combustion system. It should be installed on the combustion air intake collar or inlet PVC. If furnace location is such that this opening might be unintentionally obstructed, a 3" PVC elbow should be installed on the collar, and the screen placed inside the inlet of the elbow. See Figure 4.

Installation In An Unconfined Space

⚠ CAUTION:

"Tight" buildings (with weather stripping and caulk to reduce infiltration), may require special provisions for introduction of outside air to ensure satisfactory combustion and venting, even though the furnace is located in an unconfined space.

An unconfined space is an area including all rooms not separated by doors with a volume greater than 50 cubic feet per 1,000 Btuh of the combined input rates of all appliances which draw combustion air from that space. For example, a space including a water heater rated at 45,000 Btuh and a furnace rated at 80,000 Btuh requires a volume of 6,250 cubic feet [50 x (45 + 80) = 6,250] to be considered unconfined. If the space has an 8 foot ceiling, the floor area of the space must be 750 square feet (6,250 / 8 = 781). In general, a furnace installed in an unconfined space will not require outside air for combustion.

⚠ WARNING:

Furnaces installed with combustion air drawn from a heated space which includes exhaust fans, fireplaces, or other devices that may produce a negative pressure should be considered confined space installations.

Installation In A Confined Space

A confined space is one which does not meet the unconfined space volume requirements, and typically involves installation in a small room. All such installations must have specific provisions for introduction of combustion and ventilation air. *Codes require that two openings be provided for this - one with bottom edge within 12" of the floor and one with top edge within 12" of the ceiling.* The size and other criteria for these openings must be per the following sections.

Combustion air openings must not be restricted in any manner.

Furnaces installed in a confined space which supply circulating air to areas outside of the space must draw return air from outside the space and must have return air ducts tightly sealed to the furnace.

Air From Inside

Air for combustion and ventilation may be taken from inside the building through an interior wall *if the building is not "tight" and if the total volume of the furnace space and the space from which air is drawn meets the volume requirements for an unconfined space.* In such cases, the two openings in the wall must each have free area of at least one square inch per 1000 Btuh of *total* appliance input, but not less than 100 square inches of free area. See Figure 5. For example, if the combined input rate of all appliances is less than or equal to 100,000 Btuh, *each* opening must have a free area of at least 100 square inches. If the combined input rate of all appliances is 120,000 Btuh, *each* opening must have a free area of at least 120 square inches. (See Figure 5.)

Air Directly Through An Exterior Wall
If combustion air is provided directly through an exterior wall, the two openings must *each* have free area of at least one square inch per 4000 Btuh of *total* appliance input. (See Figure 6.)

Outdoor Air Through Vertical Openings or Ducts
If combustion air is provided through vertical ducts or openings to attics or crawl spaces, the two openings must each have free area of at least one square inch per 4000 Btuh of total appliance input. Ducts must have cross-sectional areas at least as large as the free area of their respective openings to the furnace space. Attics or crawl spaces must communicate freely with the outdoors if they are the source of air for combustion and ventilation. (See Figures 7 and 8.)

Outdoor Air Through Horizontal Openings or Ducts
If combustion air is taken from outdoors through horizontal ducts, the openings must *each* have free area of at least one square inch per 2000 Btuh of total appliance input. Ducts must have cross-sectional area at least as large as the free area of their respective openings to the furnace space. (See Figure 9.)

⚠ CAUTION:

Do not supply combustion air from an attic space that is equipped with power ventilation or any other device that may produce a negative pressure.

VENTING REQUIREMENTS

This section specifies installation requirements for vent and "2-pipe" combustion air piping. For "one pipe" installations, install vent piping per this section and provide air for combustion and ventilation per the previous section. The capacity table provided in this section applies to the total of vent and combustion air piping for either type of installation.

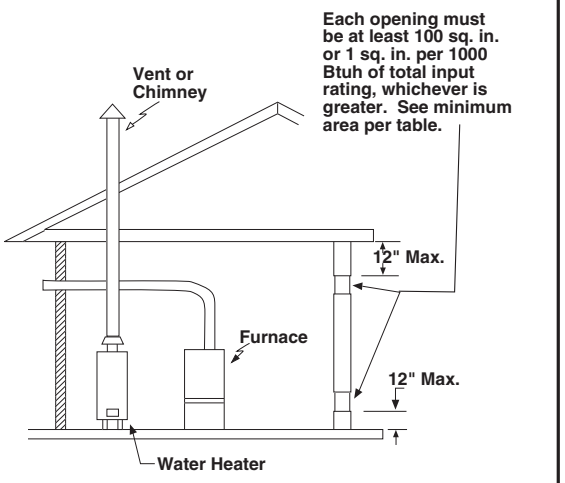
These condensing furnaces are classified as "Category IV" appliances, which require special venting materials and installation procedures. Category IV appliances operate with positive vent pressure and therefore require vent systems which are thoroughly sealed. They also produce combustion condensate,

APPLICATION	SINGLE PIPE LENGTH (ft.) with 1 long radius elbow**		DIRECT VENT, DUAL PIPE LENGTH (ft.) with 1 long radius elbow on each pipe**					
PVC,CPVC or ABS	Outlet	Outlet	Inlet/Outlet		Inlet/Outlet		Inlet/Outlet	
SCH. 40 Pipe Size	2"	3"	2"	2"	3"	2"	3"	3"
Models *TE 060	65	200	30	30	40	40	110	110
Models *TE 80	45	200	30	30	40	40	110	110
Models *TE 100	40	200	25	25	40	40	110	110
Models *TE 120	40	200	20	20	40	40	110	110

**NOTES

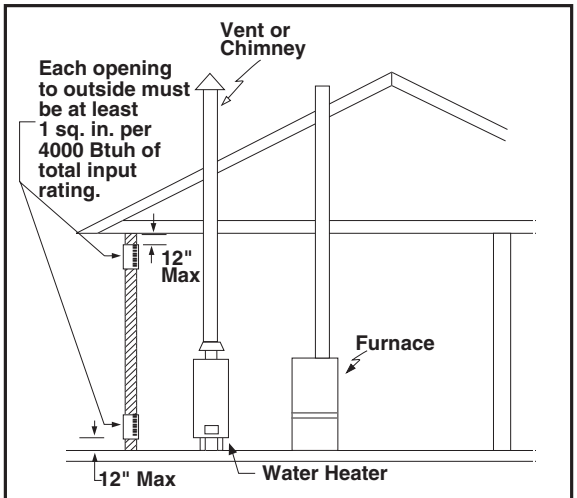
1. Subtract 2.5 ft. for each additional 2" **long** radius elbow, 5 ft. for each additional 2" **short** radius elbow, 3.5' for each additional 3" **long** radius elbow, and 7' for each additional 3" **short** radius elbow.
2. Two 45 degree elbows are equivalent to one 90 degree elbow.
3. Do not include termination elbows in calculation of vent length
4. This table is applicable for elevations from sea level to 2000 ft. For higher elevations decrease vent pipe lengths by 8% per 1000 ft. of altitude.
5. Only the above pipe materials are approved for use with these condensing furnaces.

Table 3. Vent Table


Each opening must be at least 100 sq. in. or 1 sq. in. per 1000 Btuh of total input rating, whichever is greater. See minimum area per table.
Vent or Chimney
12" Max.
Furnace
12" Max.
Water Heater

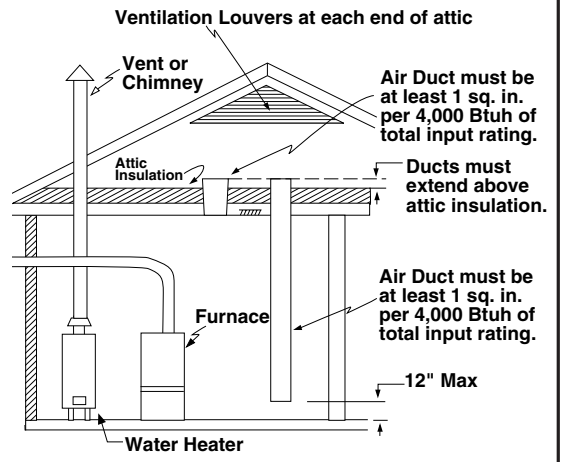
Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	100 sq. in.	12"
60,000	100 sq. in.	12"
80,000	100 sq. in.	12"
100,000	100 sq. in.	12"
120,000	120 sq. in.	13"
140,000	140 sq. in.	14"
160,000	160 sq. in.	15"

Figure 5. Equipment in a Confined Space with all Combustion Air drawn from Inside


Vent or Chimney
Each opening to outside must be at least 1 sq. in. per 4000 Btuh of total input rating.
12" Max
Furnace
12" Max
Water Heater

Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	10 sq. in.	4"
60,000	15 sq. in.	5"
80,000	20 sq. in.	5"
100,000	25 sq. in.	6"
120,000	30 sq. in.	6"
140,000	35 sq. in.	7"
160,000	40 sq. in.	8"

Figure 6. Equipment in a Confined Space with all Combustion Air drawn from Outdoors through Exterior Wall


Ventilation Louvers at each end of attic
Vent or Chimney
Air Duct must be at least 1 sq. in. per 4,000 Btuh of total input rating.
Attic Insulation
Ducts must extend above attic insulation.
Air Duct must be at least 1 sq. in. per 4,000 Btuh of total input rating.
Furnace
12" Max
Water Heater

Total Input Rating (Btuh)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	10 sq. in.	4"
60,000	15 sq. in.	5"
80,000	20 sq. in.	5"
100,000	25 sq. in.	6"
120,000	30 sq. in.	6"
140,000	35 sq. in.	7"
160,000	40 sq. in.	8"

Figure 7. Equipment in a Confined Space with all Combustion Air drawn from Outdoors through Vertical Ducts – from Ventilated Attic

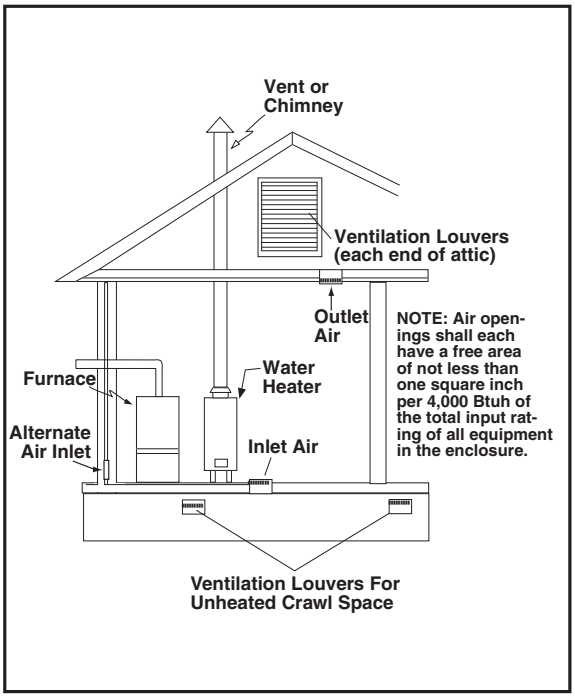
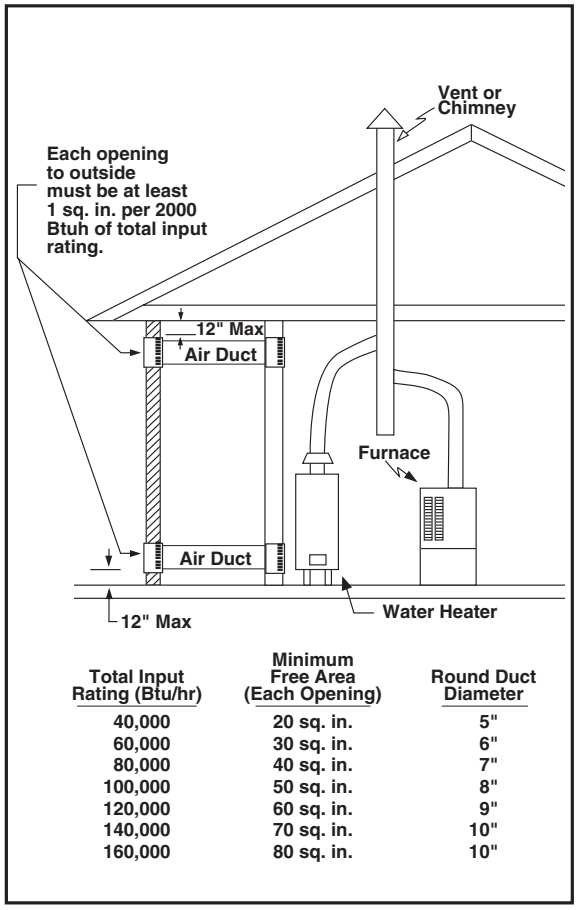

Vent or Chimney
Ventilation Louvers (each end of attic)
Outlet Air
NOTE: Air openings shall each have a free area of not less than one square inch per 4,000 Btuh of the total input rating of all equipment in the enclosure.
Furnace
Water Heater
Alternate Air Inlet
Inlet Air
Ventilation Louvers For Unheated Crawl Space

Figure 8. Equipment in a Confined Space with all Combustion Air drawn from Outdoors through Ventilated Crawl Space and Ventilated Attic


Vent or Chimney
Each opening to outside must be at least 1 sq. in. per 2000 Btuh of total input rating.
12" Max
Air Duct
Furnace
Air Duct
Water Heater
12" Max

Total Input Rating (Btu/hr)	Minimum Free Area (Each Opening)	Round Duct Diameter
40,000	20 sq. in.	5"
60,000	30 sq. in.	6"
80,000	40 sq. in.	7"
100,000	50 sq. in.	8"
120,000	60 sq. in.	9"
140,000	70 sq. in.	10"
160,000	80 sq. in.	10"

Figure 9. Equipment in a Confined Space with all Combustion Air Drawn from the Outside through Horizontal Ducts

which is slightly acidic and can cause severe corrosion of ordinary venting materials. Furnace operation can be adversely affected by restrictive vent and combustion air piping. Therefore, *vent and combustion air piping lengths must conform completely to the requirements of Table 3.*

The furnace must be vented to the outdoors. It must not be vented in common with any other appliance, even if that appliance is of the condensing type. Common venting can result in severe corrosion of other appliances or their venting and can allow combustion gases to escape through such appliances or vents. Do not vent the furnace to a fireplace chimney or building chase.

⚠ WARNING:

FURNACE MUST NOT BE COMMON VENTED WITH OTHER APPLIANCES.

⚠ WARNING:

CARBON MONOXIDE POISONING HAZARD

1. **Seal any unused openings in the venting system**
2. **Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1 or the CAN/CGA B149 Installation Codes and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.**
3. **So far as is practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.**
4. **Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so appliance shall operate continuously.**
5. **Turn on clothes dryers and any other appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Do not operate a summer exhaust fan.**
6. **Close fireplace dampers.**
7. **Test for spillage from draft hood equipped appliance at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.**
8. **If improper venting is observed during any of the above tests, the venting system must be corrected in accordance with the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* and/or *CSA B149.1, Natural Gas and Propane Installation Codes.***
9. **After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.**

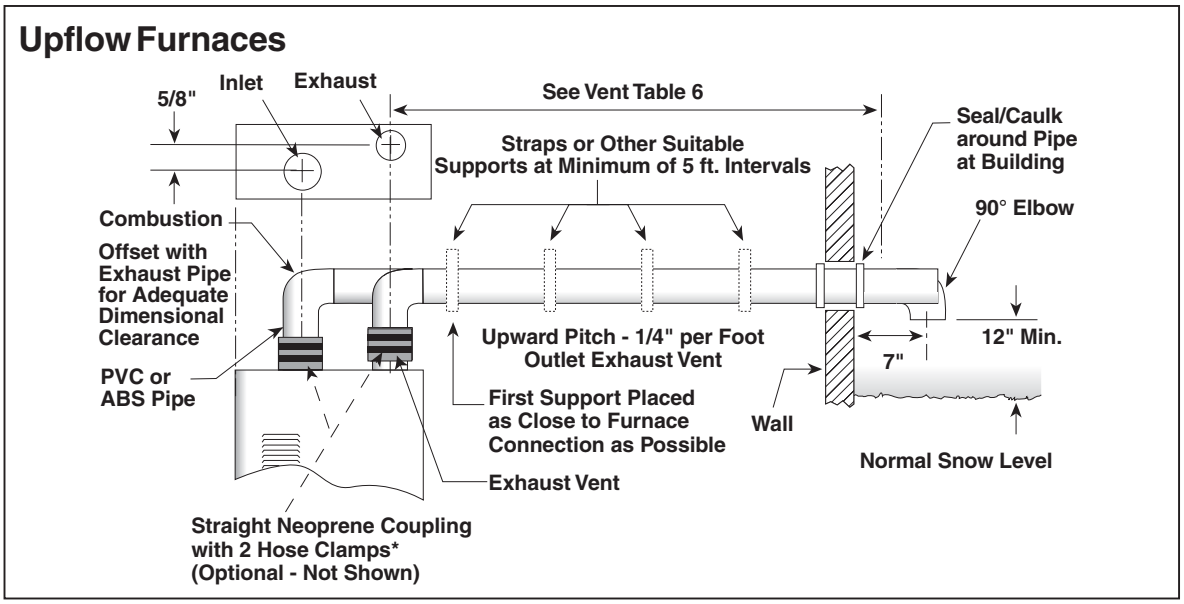


Figure 10. Horizontal Venting

* These neoprene couplings are field-supplied and can be used if the installation requires breakable connections in the piping. Note that a maximum of two couplings per pipe are allowed.

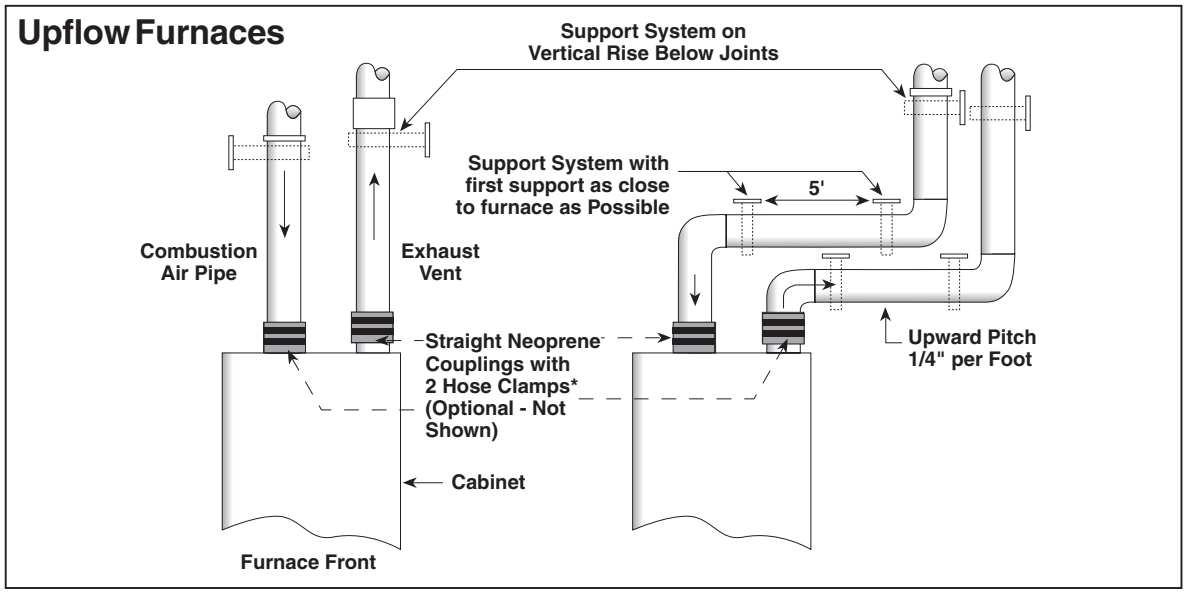


Figure 11. Vertical Venting

* These couplings are field-supplied and can be used if the installation requires breakable connections in the piping. Note that a maximum of two couplings per pipe are allowed.

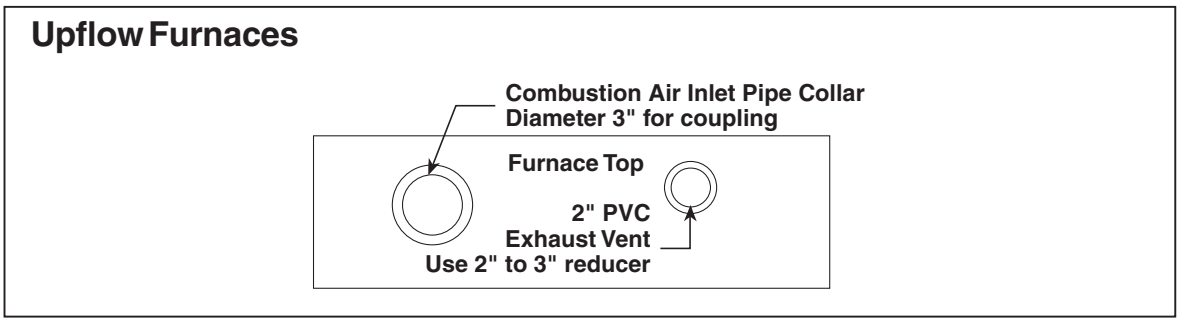


Figure 12. Furnace Pipe Adaptions

Vent Pipe Material

Vent and combustion air pipe and fittings must be one of the following materials and must conform to the indicated ANSI/ASTM standards:

Material	Standard
Schedule 40 PVC	D1785
PVC-DWV	D2665
SDR-21* & SDR-26*	D2241
ABS-DWV	D2661
Schedule 40 ABS	F628
Foam/Cellular Core PVC	F891

*In Canada, check the local codes to ensure that SDR is approved for use. SDR is not approved for all Canadian installations.

Cement and primer must conform to ATSM Standard D2564 for PVC and Standard D2235 for ABS. When joining PVC piping to ABS, use PVC solvent cement. (See procedure specified in ASTM Standard D3138.)

Vent Pipe Length and Diameter

In order for the furnace to operate properly, the combustion air and vent piping must not be excessively restrictive. To ensure this use Table 3, which indicates the maximum allowable piping length for a furnace of specified input rate, when installed with piping of selected diameter and number of elbows. This table applies to the length and number of elbows for each pipe. To use the table, the furnace input rate, the centerline length and the number of elbows on each pipe must be known. Choose the diameter for which the tabulated length is equal to or greater than required.

Proper use of the table is illustrated by the following example:

Example:
A 120,000 Btu/h furnace is to be installed in a "one-pipe" system with 40 feet of vent piping. There are a total of four long radius 90-degree elbows used in the vent, including the one exterior to the building.

Solution:
For this particular installation, the equivalent vent length must be calculated. This equivalent vent length will then be compared to the maximum allowable vent length given in Table 3. Then, the diameter of the piping can be chosen for which the equivalent vent length is less than the maximum allowable vent length. Returning to our example, we consult Table 3 and determine that for a 120,000 Btu/h furnace the maximum vent length for 3" diameter piping is 110 feet. Note that the maximum vent length given in Table 3 includes one long radius elbow. Therefore, for our example, we have three additional long radius elbows for which we must add to our piping. Each long radius elbow is equivalent to 2.5 feet, so we must add 7.5 feet to our vent length. Therefore, the equivalent vent length for our installation is 47.5 feet. We compare this with the maximum vent length for 3” diameter piping. Our equivalent vent length is less than the maximum allowable vent length, so for our “one-pipe” installation we can use 3” diameter piping.

Condensing furnace combustion products have very little buoyancy, so Table 3 is to be used without consideration of any vertical rise in the piping.

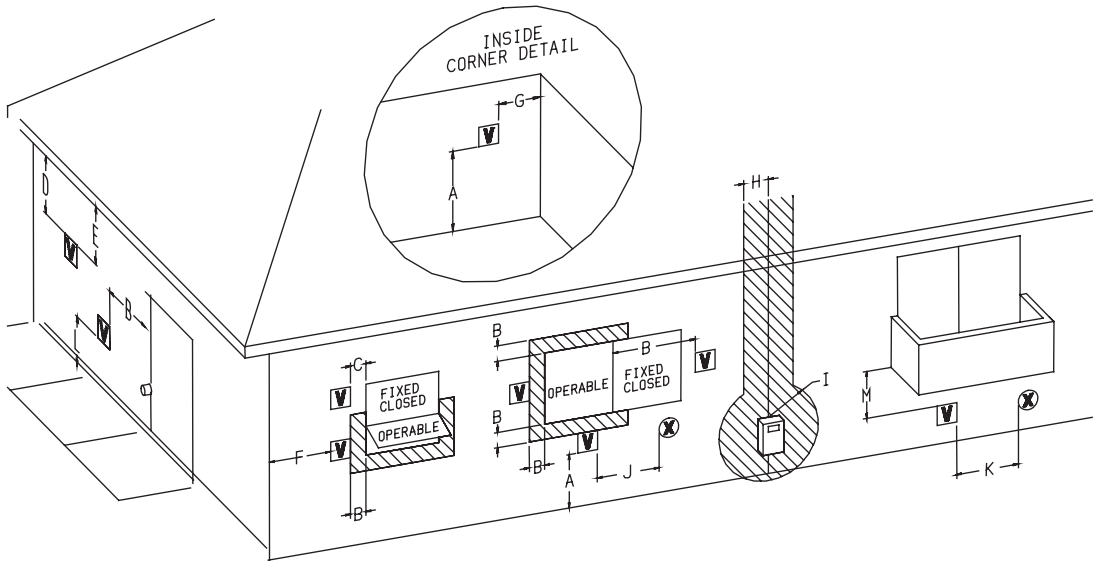
Vent Pipe Installation

Pipe Routing and Support
Route piping as directly as possible between the furnace and the outdoors and remember that routing affects pipe size requirements per the preceding section. If a two pipe system is used, locate the combustion air intake and the vent exhaust in the same atmospheric pressure zone - i.e. both must exit the building though the same portion of exterior wall or roof. Vent piping must be sloped upwards not less than 1/4” per foot in the direction from the furnace to the terminal. This is to ensure that any condensate flows back to the furnace (where it can be disposed of through the condensate disposal system).

The quality of outdoor air must also be considered. Be sure that the combustion air intake is not located near a source of solvent fumes or other chemicals which can cause corrosion of the furnace combustion system.

⚠ CAUTION:

Combustion air must not be drawn from a corrosive atmosphere.

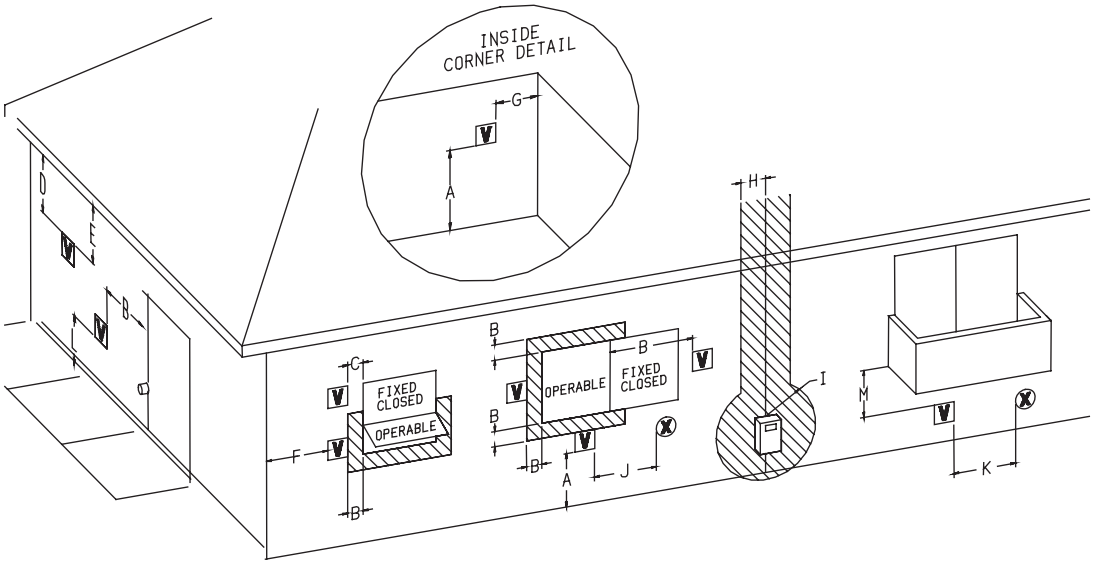


VENT TERMINAL **AIR SUPPLY INLET** **AREA WHERE TERMINAL IS NOT PERMITTED**

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 inches (30 cm)	12 inches (30 cm)
B =	Clearance to window or door that may be opened	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,00 Btuh (30 kW), 36 inches (91 cm) for appliances >100,00 Btuh (30 kW)	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 inches (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 inches (30 cm) for appliances > 50,000 Btuh (15 kW)
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter/regulator assembly	3 feet (91 cm) within a height 15 feet above the meter/regulator assembly	*
I =	Clearance to service regulator vent outlet	3 feet (1.83 m)	*
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,00 Btuh (30 kW), 36 inches (91 cm) for appliances >100,00 Btuh (30 kW)	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 inches (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 inches (30 cm) for appliances > 50,000 Btuh (15 kW)
K =	Clearance to a mechanical air supply inlet	6 feet (1.83 m)	3 feet (91 cm) above if within 10 feet (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.13 m) †	*
M =	Clearance under veranda, porch deck, or balcony	12 inches (30 cm) ‡	*

[1] In accordance with the current CSA B149.1 *Natural Gas and Propane Installation Code*
[2] In accordance with the current ANSI Z223.1 / NFPA 54 *National Fuel Gas Code*
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
* For clearances not specified in ANSI Z223.1 / NFPA 54 or CSA B149.1, the following statement shall be included:
"Clearance in accordance with local installation codes, and the requirements of the gas supplier and the manufacturer's installation instructions."

Figure 13. Vent Termination Clearances for Direct Vent Furnaces



V **VENT TERMINAL** **X** **AIR SUPPLY INLET** **AREA WHERE TERMINAL IS NOT PERMITTED**

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 inches (30 cm)	12 inches (30 cm)
B =	Clearance to window or door that may be opened	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,00 Btuh (30 kW), 36 inches (91 cm) for appliances >100,00 Btuh (30 kW)	4 feet (1.2 m) below or to side of opening; 1 foot (300 mm) above opening
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter/regulator assembly	3 feet (91 cm) within a height 15 feet above the meter/regulator assembly	*
I =	Clearance to service regulator vent outlet	3 feet (1.83 m)	*
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,00 Btuh (30 kW), 36 inches (91 cm) for appliances >100,00 Btuh (30 kW)	4 feet (1.2 m) below or to side of opening; 1 foot (300 mm) above opening
K =	Clearance to a mechanical air supply inlet	6 feet (1.83 m)	3 feet (91 cm) above if within 10 feet (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.13 m) †	7 feet (2.13 m)
M =	Clearance under veranda, porch deck, or balcony	12 inches (30 cm) ‡	*

[1] In accordance with the current CSA B149.1 Natural Gas and Propane Installation Code
[2] In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
* For clearances not specified in ANSI Z223.1 / NFPA 54 or CSA B149.1, one of the following statement shall be included:
"Clearance in accordance with local installation codes, and the requirements of the gas supplier and the manufacturer's installation instructions."

Figure 14. Vent Termination Clearances for other than Direct Vent Furnaces

Piping must be mechanically supported so that its weight does not bear on the furnace. Supports must be at intervals no greater than five feet, and at smaller intervals if necessary to ensure that there are no sagging sections to trap water. (See Figures 10 and 11.) It is recommended to install couplings along the vent pipe, on either side of the exterior wall. These couplings may be required by local code.

Figure 12 illustrates vent and combustion air pipe sizes exiting the furnace. Transition to the correct pipe size (i.e. from 2" to 3" diameter) must be done close to the furnace so that the full length of pipe is of proper size.

Straight neoprene couplings are supplied with the downflow furnaces only. These couplings are to be installed in the combustion air inlet (if present) and exhaust vent piping at the furnace as shown in Figure 11. For an upflow furnace installation, if breakable connections are required in the combustion air inlet (if present) and exhaust vent piping, then straight neoprene couplings for 3" piping with hose clamps can be used. These couplings can be ordered through your local furnace distributor.

To install a coupling, slide the rubber coupling over the end of the pipe that is attached to the furnace and secure it with one of the hose clamps. Then slide the other end of the rubber coupling onto the other pipe from the vent and secure the coupling with the second hose clamp. For the upflow models, the combustion air pipe can be attached to the furnace. Ensure that the connection is tight and leak free.

These condensing furnaces have been certified for installation with zero clearance between vent piping and combustible surfaces. However, it is good practice to allow space for convenience in installation and service.

Location of Outdoor Terminations

Horizontal Venting

Vent and combustion air intake terminations must be as shown in Figures13 and 14. Vent termination clearances shall be consistent with the National Fuel Gas Code, ANSI Z223.1/ NFPA 54 and/or the CSA B149.1, Natural Gas & Propane Installation code.

All minimum clearances specified must be maintained to protect building materials from degradation by flue gases.

Vent and combustion air intake terminations must be located to ensure proper furnace operation and to conform to applicable codes. Figures 13 and 14 illustrate necessary distances from the vent termination to windows and building air intakes. **In Canada, the Canadian Fuel Gas Code takes precedence over these instructions. Specifically, all minimum distance requirements with respect to termination of the vent piping listed below (items 1 through 8).**

The following list is a summary of vent terminal location requirements:

1. The termination must be 12 inches above snow level or grade level whichever is higher. See Figure 15 for alternate method to achieve 12" above snow level.
2. The minimum distance for a (1-pipe installation) from any door, (openable) window, or gravity air inlet is 4 ft. below, 4 ft. horizontally, or 1 ft. above.
3. The minimum distance for a direct vent (2-pipe installation) from any door, (openable) window, or air gravity inlet is 1 ft. below, 1 ft. horizontally, or 1 ft. above.
4. For one-pipe installations the recommended minimum distance from an inside corner formed by two exterior walls is 6 feet, but is not required.
5. The vent termination for a 1-pipe installation shall be a minimum of 3 ft. above any forced air inlet within 10 ft.

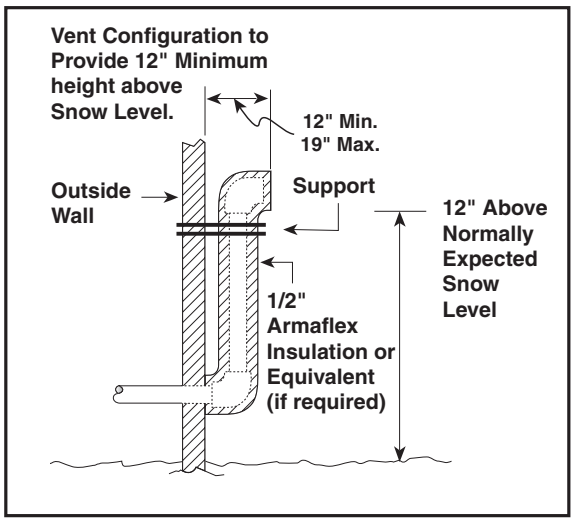

Vent Configuration to Provide 12" Minimum height above Snow Level.
12" Min.
19" Max.
Outside Wall
Support
12" Above Normally Expected Snow Level
1/2" Armaflex Insulation or Equivalent (if required)

Figure 15. Alternate Horizontal Vent Installation

6. The vent termination shall be located at least 4 ft. horizontally from any electric meter, gas meter, regulator and any relief equipment. These distances apply ONLY to U.S. installations. In Canada, the Canadian Fuel Gas Code takes precedence.
7. Avoid areas where condensate drainage may cause problems by dropping on planters or patios, etc. Also ensure that exhaust gases will not impinge on windows or building surfaces, which may be compromised or damaged by condensation. Do not install the vent terminal such that exhaust is directed into window wells, stairwells, under decks or into alcoves or similar recessed areas, and do not terminate above any public walkways.
8. Select the point of wall penetration where the minimum 1/4 inch per foot of slope up can be maintained.

⚠ CAUTION:

For optimum performance, vent furnace through wall which experiences the least exposure to winter winds.

⚠ WARNING:

Ensure that the combustion air vent and the exhaust vent are configured as shown in Figure 16. Improper vent termination can cause recirculation of the flue gases. This may result in furnace vibration. In severe cases, the furnace will cycle due to the intermittent contact between the flame and the flame sensor. If you note oscillations occurring, check the vent configuration. Make sure that the exhaust vent does not have a 90 degree termination.

For Canadian installations please refer to the Canadian Installation Code (CAN/CGA-B149.1 or 2) and/or local codes.
The kit consists of two face plates and an insulating gasket to seal the exterior surface. A hole sized closely to the pipe diameter must first be cut through the wall. A short length of pipe is then cut such that it can penetrate the wall and be held in place by closely fitting standard couplings. The face plates are retained on both sides of the wall by the couplings, and the gasket is retained against the wall by the outer face plate. Face plates must be fastened to the wall and the outside one must be flashed as appropriate to prevent entry of water.

When the above kits are not used the following steps are required:

1. Check the hole size cut through the exterior wall. Insure that the hole diameter is less than the diameter of the couplings to be used.
2. Extend the vent pipe through the wall approximately 1" and seal the area between the wall and pipe.
3. If required by local code, apply couplings to the vent pipe on the interior and exterior sides of the wall to insure the pipe can not be pushed or pulled through the wall.
4. Insure the combustion air inlet pipe (for a 2 pipe installation) has a 90 degree termination elbow as shown in Figures 16 and 17.

Note: A combustion air intake must be provided with an elbow opening downward. The screen provided with the furnace can be installed in the elbow to prevent entry of debris or creatures.

When the vent pipe must exit an exterior wall close to the grade or expected snow level, a riser should be provided as shown in Figures 15 and 16.

Table 3 describes the maximum length of flue pipe that can travel through an unconditioned space or an exterior space. The total vent length must not exceed the lengths noted on Table 8.

Vertical Venting
Figure 17 shows the proper installation and clearances for vertical vent termination. The roof penetration must be properly flashed and waterproofed with a plumbing roof boot or equivalent flashing. Termination spacing requirements from the roof and from each other must be per Figure 17.

Vent and combustion air piping may be installed in an existing chimney which is not in use provided that:

a. Both the exhaust vent and air intake run the length of the chimney.

b. The top of the chimney is sealed and weatherproofed.
c. The termination clearances shown in Figure 17 are maintained.
d. No other gas fired or fuel burning appliances are vented through the chimney.

Vent Freezing Protection

When the vent pipe is exposed to temperatures below freezing, i.e., when it passes through unheated spaces, chimneys, etc., the pipe must be insulated with 1/2 inch thick sponge rubber insulation, Armaflex-type insulation or equivalent. Insulating pipe is important to avoid condensate icing.

For extremely cold climates or for conditions of short furnace cycles (i.e. set back thermostat conditions) the last three feet of vent pipe can be reduced one nominal pipe size provided that the total vent length is at least 15 feet in length and the vent is sized in accordance with the venting requirements (Table 4) before this reduction is applied. (Example: 3" to 2-1/2") Smaller vent pipes are less susceptible to freezing, but must not be excessively restrictive.

Concentric Vent Termination

A concentric vent termination is approved for use with these furnaces. The kit part number is 904176. For proper installation of the concentric vent termination, follow the installation instructions provided with that kit.

DRAINAGE OF CONDENSATE FROM FURNACE

The condensate drainage system is internal to the furnace. It is not recommended to connect additional traps to the exterior of the furnace. Doing so will have adverse effects on the operation of the furnace. The drain may exit either the right or left side of the furnace cabinet.

The condensate drain can be routed to a flow drain or to a condensate pump. Ensure that the drain maintains a downward slope from the unit to the drain. Refer to Figure 18 for more details.

For a right side drain simply extend the tubing out of the hole in the cabinet, see Figure 18. For a left side drain follow the steps below:

1. Loosen the clamp on the soft exit tube (see Figure 18.)
2. Rotate the soft exit tube (counter clockwise, 180° upflow models; clockwise 90° downflow models.)
3. Re-tighten the clamp. MAKE SURE CLAMP IS TIGHT TO AVOID LEAKAGE OF CONDENSATE.
4. Route the tubing out of the hole located 8 inches up from the bottom furnace.

The condensate should drain from the plastic collector box (location A in Figure 18) as droplets or a small stream. If you notice the furnace has operated for more than 5 minutes without

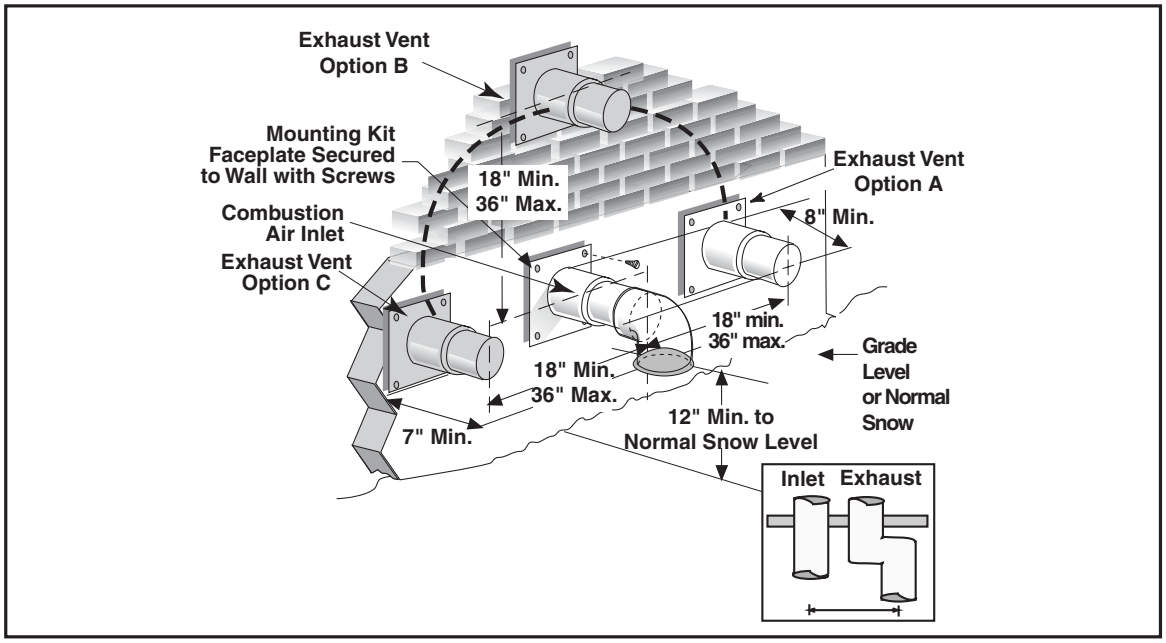


Figure 16. Exhaust and Combustion Air Pipe Clearances

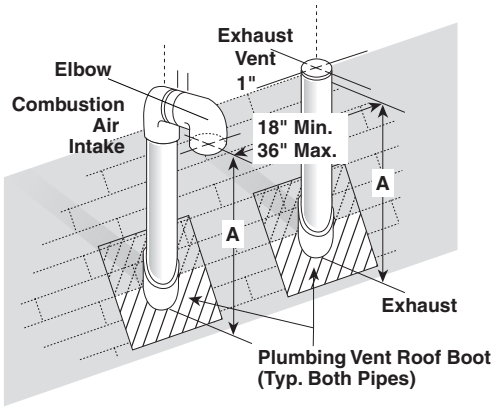


Figure 17. Vertical Vent Termination

draining or the red status light on the control board is pulsing a 2-blink code follow the steps below.

1. Remove the collector box soft tube at location A in Figure 18 and insure the exit from the collector box is clear of any debris or obstructions.
2. Replace this tube and insure the fit to the header spout is air tight. Air will be drawn into the header if this connection is not tight.
3. Check other tube connections along the drain system. Insure that all are air tight.

NOTE: Industry research studies indicate that when condensate is routed to an active drain, household detergents, etc., buffer its acidity. If the drain is not actively used or if codes require, obtain a neutralizer kit NORDYNE part no. 902373 (usually contains limestone). Proper drains and connections to the condensate tubing are required as NORDYNE cannot be held responsible for water leakage which occurs due to loose hose connections or improperly sealed drain line pipes.

GAS SUPPLY AND PIPING

This furnace is equipped for either left or right side gas entry. Typical gas service hook-ups are shown in Figure 19. When making the gas connection provide clearance between the gas supply line and the entry hole in the furnace casing to avoid unwanted noise and/or damage to the furnace.

All gas piping must be installed in compliance with local codes and utility regulations. Some local regulations require the installation of a manual main shut-off valve and ground joint union external to the furnace. The shut-off valve should be readily accessible for service and/or emergency use. Consult the local utility or gas supplier for additional requirements regarding placement of the manual main gas shut-off. In the absence of local codes the gas line installation must comply with the latest edition of the National Fuel Gas Code (ANSI Z223.1) or (CAN/CGA B149) installation codes.

An 1/8" NPT plugged tap must be installed in the gas line to the unit for use when measuring the gas supply pressure. The plug should be readily accessible for service use. A drip leg should be installed in the vertical pipe run to the unit. Table 6 lists gas flow capacities for standard pipe

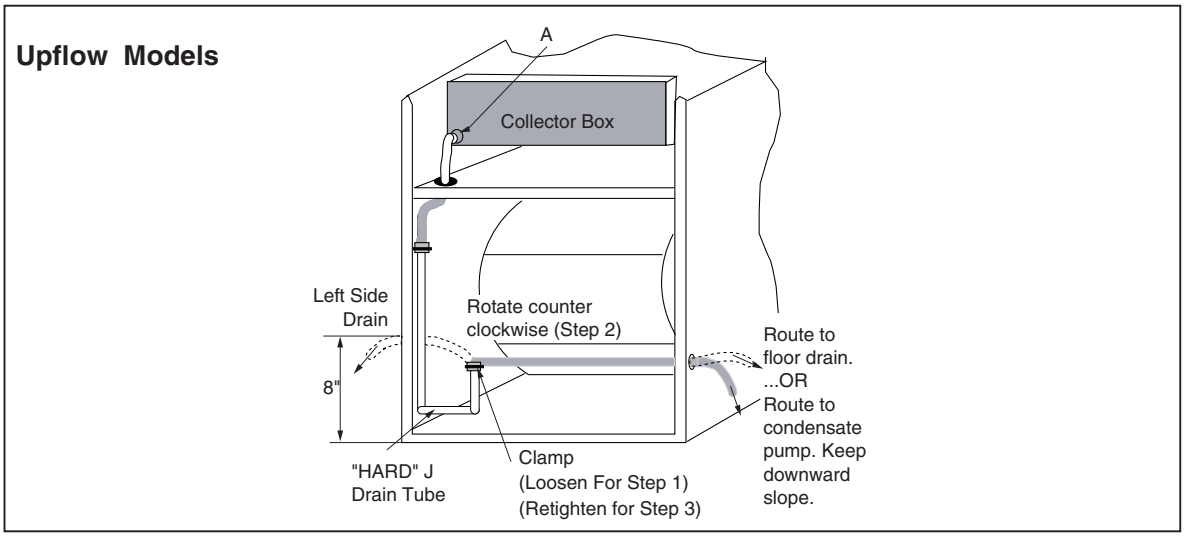


Figure 18. Furnace with Condensate Drain Trap Assembly

	Maximum Flue Pipe Length in Unconditioned and Exterior Spaces	
Winter Design Termperature (°F)	Without Insulation (feet)	With Insulation (feet) ‡
20	70	90
0	45	90
-20	35	80

‡ = Insulation thickness greater than 3/8 inch, based on an R value of 3.5 (ft*°F*hr)/(BTU*in)

Table 4. Vent Protection

sizes as a function of length in typical applications based on nominal pressure drop in the line.

NOTE: Gas piping must not be run in or through air ducts, chimneys, gas vents, elevator shafts, etc.

Compounds used on threaded joints of gas piping must be resistant to the actions of liquefied petroleum gases.

The main manual gas valve and main power disconnect to the furnace must be properly labeled by the installer in case emergency shutdown is required.

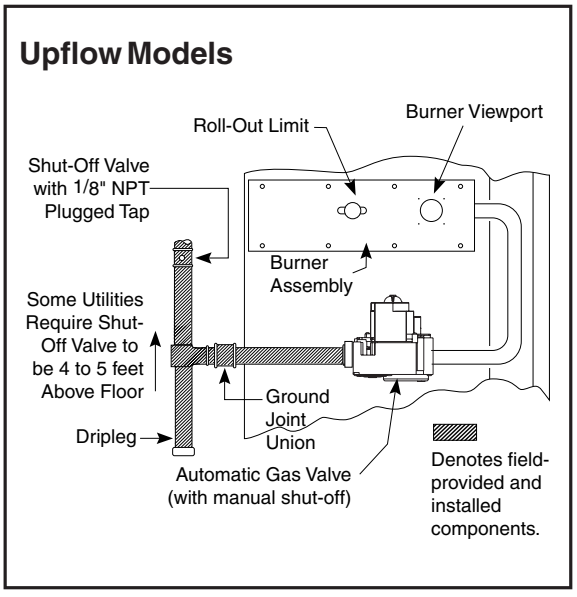

Upflow Models
Roll-Out Limit
Burner Viewport
Shut-Off Valve with 1/8" NPT Plugged Tap
Burner Assembly
Some Utilities Require Shut-Off Valve to be 4 to 5 feet Above Floor
Ground Joint Union
Dripleg
Automatic Gas Valve (with manual shut-off)
Denotes field-provided and installed components.

Figure 19. Typical Gas Service Connection

⚠ CAUTION:

Do not use matches, lighters, candles, or other sources of open flame to check for gas leaks.

Leak Check

After the gas piping to the furnace is complete, all connections must be tested for gas leaks.

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

IMPORTANT NOTE: When pressure testing gas supply lines at pressures greater than 1/2 psig (14 in. water column), the furnace must be disconnected from the gas supply piping system to prevent damage to the gas control valve. If the test pressure is less than or equal to 1/2 psig (14 in. water column), the furnace must be isolated from the gas supply line by closing the manual shut-off valve.

CAPACITY OF BLACK IRON GAS PIPE (CU. FT. PER HOUR) FOR NATURAL GAS (SPECIFIC GRAVITY - 0.60)								
NOMINAL BLACK IRON PIPE DIAMETER (in.)	LENGTH OF PIPE RUN (feet)							
	10	20	30	40	50	60	70	80
1/2	130	90	75	65	55	50	45	40
3/4	280	190	150	130	115	105	95	90
1	520	350	285	245	215	195	180	170
1 1/4	1050	730	590	500	440	400	370	350
1 1/2	1600	1100	890	760	670	610	560	530

The cubic feet per hour listed in the table above must be greater than the cubic feet per hour of gas flow required by the furnace. To determine the cubic feet per hour of gas flow required by the furnace, divide the input rate of the furnace by the heating value of the gas:

$$\text{Cubic Feet Per Hour Required} = \frac{\text{Input To Furnace (Btu/hr)}}{\text{Heating Value of Gas (Btu/Cu. Ft.)}}$$

Table 5. Capacity of Black Iron Gas Pipe (cu. ft. per hour) for Natural Gas (specific gravity = .60)

For a Natural Gas Sea Level Heating Value of 800 to 899 Btu/cu.ft.						
		Elevation (feet above sea level)				
		zero to 1999	2000 to 4999	5000 to 5999	6000 to 7999	8000 to 10000
Manifold Pressure Setting (in WC)	Full Input	3.5	3.5	3.5	3.5	3.0
	Low Input	1.7	1.7	1.7	1.7	1.6

For a Natural Gas Sea Level Heating Value of 900 to 999 Btu/cu.ft.						
		Elevation (feet above sea level)				
		zero to 1999	2000 to 4999	5000 to 5999	6000 to 7999	8000 to 10000
Manifold Pressure Setting (in WC)	Full Input	3.5	3.5	3.5	3.2	2.8
	Low Input	1.7	1.7	1.7	1.6	1.5

For a Natural Gas Sea Level Heating Value of 1,000 to 1,100 Btu/cu.ft.						
		Elevation (feet above sea level)				
		zero to 1999	2000 to 4999	5000 to 5999	6000 to 7999	8000 to 10000
Manifold Pressure Setting (in WC)	Full Input	3.5	3.5	3	2.8	2.5
	Low Input	1.7	1.7	1.5	1.4	1.3

Table 6. Manifold Pressure (in WC) for Natural Gas at Various Altitudes

For a LP Gas Sea Level Heating Value of 2,500 Btu/hr.						
		Elevation (feet above sea level)				
		zero to 1999	2000 to 4999	5000 to 5999	6000 to 7999	8000 to 10000
Manifold Pressure Setting (in WC)	Full Input	10	8.5	10	9	8.5
	Low Input	5.5	5.5	6.5	6.5	6.5

Table 7. Manifold Pressure (in WC) for LP/Propane Gas at Various Altitudes

⚠ WARNING:

This furnace was equipped at the factory for use with natural gas only. A special kit, supplied by the manufacturer, is required to convert the furnace to operate on LP/propane gas. Failure to use the proper conversion kit can cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.

MANIFOLD PRESSURE ADJUSTMENT

Manifold pressures for low and high stages are independently adjustable. Adjustment tap locations on the valve are shown in Figure 20. Manifold pressure would be adjusted below procedure:

- Turn off gas shut off valve outside furnace.
- Install manometer on the gas valve at the outlet pressure tap.
- Turn on the shut off. Run furnace at high fire and set manifold pressure. Also set manifold pressure while running at low fire (refer to Tables 6 and 7.)
- Ensure plug is tight after removing manometer.

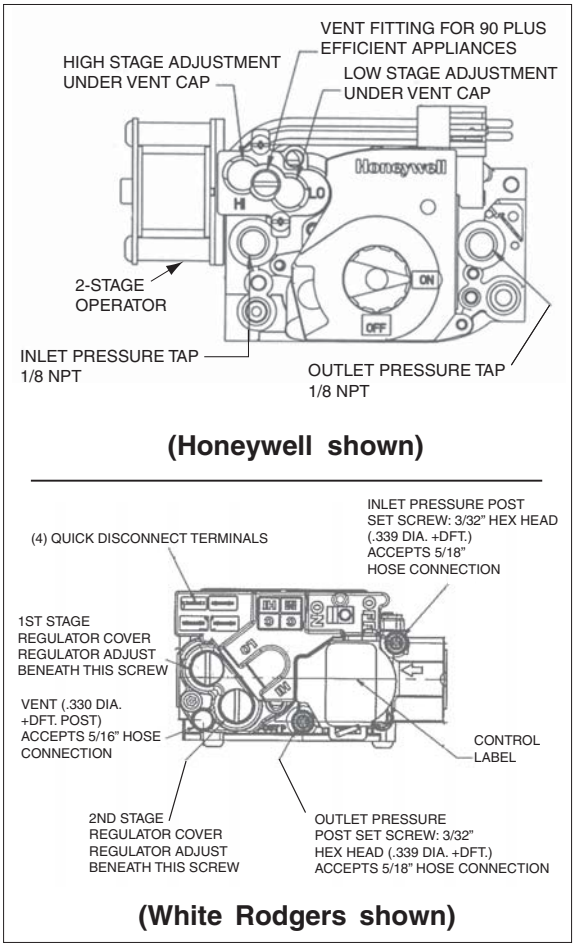

VENT FITTING FOR 90 PLUS EFFICIENT APPLIANCES
HIGH STAGE ADJUSTMENT UNDER VENT CAP
LOW STAGE ADJUSTMENT UNDER VENT CAP
Honeywell
H
LO
ON
OFF
2-STAGE OPERATOR
INLET PRESSURE TAP 1/8 NPT
OUTLET PRESSURE TAP 1/8 NPT
(Honeywell shown)
(4) QUICK DISCONNECT TERMINALS
INLET PRESSURE POST SET SCREW: 3/32" HEX HEAD (.339 DIA. +DFT.) ACCEPTS 5/18" HOSE CONNECTION
1ST STAGE REGULATOR COVER REGULATOR ADJUST BENEATH THIS SCREW
VENT (.330 DIA. +DFT. POST) ACCEPTS 5/16" HOSE CONNECTION
CONTROL LABEL
2ND STAGE REGULATOR COVER REGULATOR ADJUST BENEATH THIS SCREW
OUTLET PRESSURE POST SET SCREW: 3/32" HEX HEAD (.339 DIA. +DFT.) ACCEPTS 5/18" HOSE CONNECTION
(White Rodgers shown)

Figure 20. Gas Valve

Conversion

Conversion of this furnace to use LP/propane gas must be made by qualified service personnel, using **only** approved parts.

IMPORTANT NOTE: When converting a low NOx furnace from Natural Gas to LP/Propane Gas, it is necessary to remove the NOx baffles from the furnace.

HIGH ALTITUDE CONVERSION

High Altitude Application

Conversion of this furnace to replace the pressure switch or to utilize LP/propane gas must be made by qualified service personnel, using factory authorized or approved parts. High altitude applications with this furnace can be field performed by a simple adjustment of manifold pressure, and if necessary changing the orifices and the vent pressure switch. The changes required depend on the installation altitude and the heating value of the gas. The gas heating value based on sea level can be obtained from your local gas utility. The heating value of gas at high altitude is always lower than the sea level heating value. The heating values used in Tables 10 and 11 are based on sea level values.

Pressure Switch Conversion for High Altitude Applications

These units are factory equipped to operate between zero and 8000 feet above sea level. For higher altitude applications, you may need to replace the vent pressure switch in addition to the main gas burner orifices.

Natural Gas High Altitude Conversion

All factory shipped furnaces are ready to operate between zero and 4999 ft. above sea level. For higher altitudes (between 5000 and 10,000 ft. above sea level), conversion can be achieved simply by adjusting the furnace manifold pressure as shown in Tables 6 and 7.

Furnace High Fire Rating Plate Input (Btu/h)	Orifice Drill Size	
	Nat.	LP
60,000	49	56
80,000	45	55
100,000	45	55
120,000	45	55

Table 8. Natural and LP Gas Orifice Sizes for Elevations between zero and 4999 ft. Above Sea Level

Furnace High Fire Rating Plate Input (Btu/h)	Orifice Drill Size	
	Nat.	LP
60,000	49	57
80,000	45	56
100,000	45	56
120,000	46	56

Table 9. Natural and LP gas Orifice Sizes for Elevations between 5000 and 10,000 ft. Above Sea Level

LP/Propane Gas Sea Level and High Altitude Conversion

Conversion to LP/propane gas can be accomplished by first replacing the natural gas orifices with the appropriate LP/propane orifices shown in Table 8 or 9 Note: for installations between zero and 5000 ft. above sea level, refer to Table 8. For installations above 5000 ft. above sea level, refer to Table 9. After changing the orifices, use Tables 7 and 9 to determine the appropriate manifold pressure for your installation.

Conversion to LP/propane, sea level, and high altitude is detailed in the installation instructions provided with the conversion kit. Approved conversion kits are listed below.

United States LP/Propane Gas Sea Level and High Altitude Conversion Kit - P/N 904404
This kit is for LP/propane conversion in the United States at altitudes between zero and 10,000 ft. above sea level. Follow the installation instructions supplied with the kit for proper installation.

Canadian LP/Propane Gas Sea Level and High Altitude Conversion Kit - P/N 904405
This kit is for LP/propane conversions in Canada at altitudes between zero and 4500 ft. above sea level. Follow the installation instructions supplied with the kit for proper installation.

⚠ CAUTION:

To avoid electric shock, personal injury, or death, turn off the power at the disconnect or the main service panel before making any electrical connections.

ELECTRICAL WIRING

Electrical connections must be made in accordance with all applicable local codes and ordinances, and with the current revision of the National Electric Code (ANSI/NFPA 70).

For Canadian installations electrical connections and grounding must be done in accordance with the current Canadian Electrical Code (CSA C22.1 Part 1) and/or local codes. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wire having a minimum temperature rating of 105°C. Refer to the furnace nameplate and Table 10 for electrical requirements.

Line Voltage Wiring

The line voltage (115 volt) to the furnace must be supplied from a dedicated branch circuit containing the correct fuse or circuit breaker for the furnace. See Table 10. An electrical switch should be readily accessible from and within sight of the furnace. (See the Wiring Diagram label in the furnace and Figure 21.)

The furnace cabinet must have an uninterrupted, unbroken ground to minimize injury should an electrical fault condition occur. The controls used in this furnace require an earth ground to operate properly. Acceptable methods for grounding are electrical wire or conduit approved for electrical ground service. Do not use gas piping as an electrical ground.

NOTE: Proper line voltage polarity must be maintained in order for the control system to operate correctly. Verify that the incoming neutral line is connected to the white wire and the incoming "hot" line is connected to the black wire in the junction box. These furnaces will not operate unless polarity and ground are properly connected. See Figure 21.

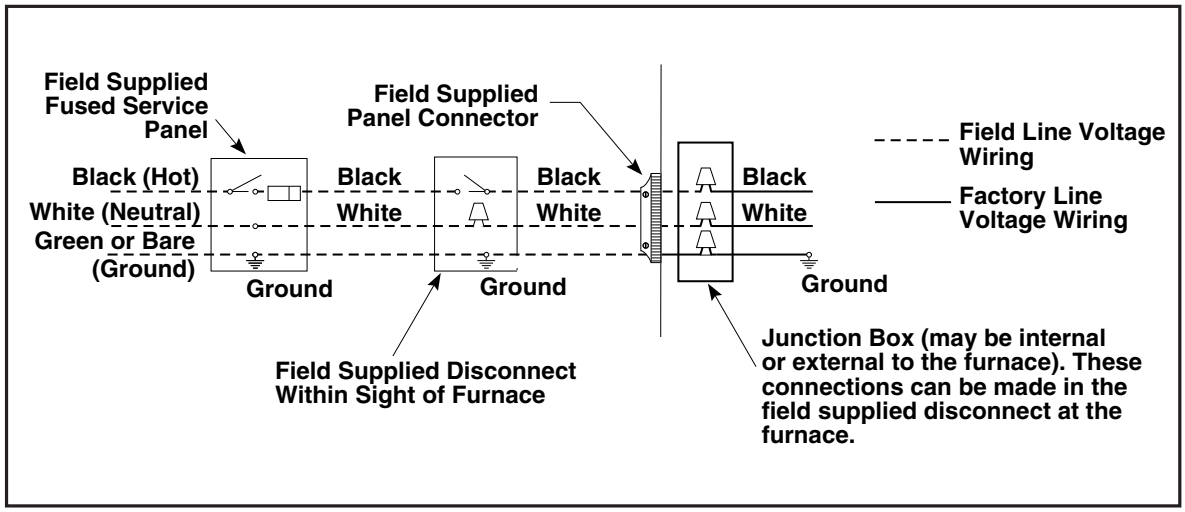


Figure 21. Line Voltage Field Wiring

⚠ CAUTION:

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

NOTE: The following procedure describes how to connect the furnace for a two-stage application.

Low Voltage Wiring

Furnace is factory configured to operate on low and high fire – two stage mode configurations. The second stage will function based on the program settings in the thermostat controller. The furnace integrated control board consists of two boards – main and add-on boards. The two boards are pre-wired with the furnace interface board. The IQ thermostat controller requires wiring to the interface board in the field (see Figures 22 and 25).

1. **Heating thermostat controller wiring**
   a. Two stage heating: (see Figure 22): Programmable controller thermostat for the two stage heating should be wired as wiring diagram shown in Figure 22. On a call for first stage heat, inducer runs for 30 seconds pre-purge at high speed. The furnace will operate on low fire and both the inducer and main blower will operate at low speed. On a call second stage heat based on programmed timing or differential temperature, the furnace will operate at high fire and both inducer and main blower will operate at high speed.

   b. Low fire only operation: To set low fire only operation, program the second stage temperature higher than the desired room temperature (refer to Thermostat controller Instructions). If the furnace is operated permanently at low stage, disconnect the yellow wire on the "W2" terminals between the furnace add-on board and the interface board. (See Figure 24).

   c. Outdoor Thermostat Function: If available on controller program.

2. **Cooling controller thermostat wiring:** (see Figure 23, 25 and cooling wiring diagram).
   Once field wired for heating, Connect "R" and "C" black wires on the Interface control board to the two black wires from the outdoor unit contactor (see Figure 23). Also connect DX+ DX- and GRD terminals between the Interface board and the outdoor unit inverter with green, white and black wires as shown in Figures 23 and 25. Cooling unit operates at the best optimized condition for the outdoor weather according to program in the thermostat controller.

Furnace Input (Btuh)	Cabinet Width (in.)	Nominal Electrical Supply	Maximum Operating Voltage	Minimum Operating Voltage	Maximum Furnace Amperes	Minimum Wire Gauge	Maximum Fuse or Circuit Breaker Amps*
60,000	19.75	115-60-1	127	103	12	14	15
80,000	19.75	115-60-1	127	103	12	14	15
92,000	19.75	115-60-1	127	103	12	14	15
110,000	22.50	115-60-1	127	103	12	14	15

*** Time-delay fuses or HACR-type circuit breakers are required.**

Table 10. Electrical Data

The thermostat controller must not be installed on an outside wall or any other location where its operation may be adversely affected. Adverse effects include radiant loading from fireplaces, sunlight, or lighting fixtures, and convective loading from warm air registers or electrical appliances.

START-UP AND ADJUSTMENTS

Prior to start-up, verify that:

1. The line voltage power leads are securely connected, that the polarity of the connections is correct, and that the furnace is properly grounded.
2. The thermostat wires (A, B, C and R) are securely connected to the correct leads on the terminal strip of the interface board. (R, DX+, DX- and Gnd. (See Figure 22.)
3. The gas line service pressure does not exceed 10.0 in. water column (0.36 psig), and is not less than 4.5 in. water column (0.16 psig) for natural gas. For LP gas the line service pressure must not exceed 14 in. water column (0.51 psig), and must not be less than 11.0 in. W.C. (0.40 psig).
4. The roll-out and vent safety manual reset switches are closed. If necessary, press the red button to reset a switch. See Figure 26 for location. DO NOT install a jumper wire across a switch to defeat its function. If a switch reopens on start-up, DO NOT reset the switch without identifying and correcting the fault condition which caused the switch to trip.
5. The blower door is in place, closing the door switch in the line voltage circuit.
6. The gas line has been purged and all connections are leak tight.

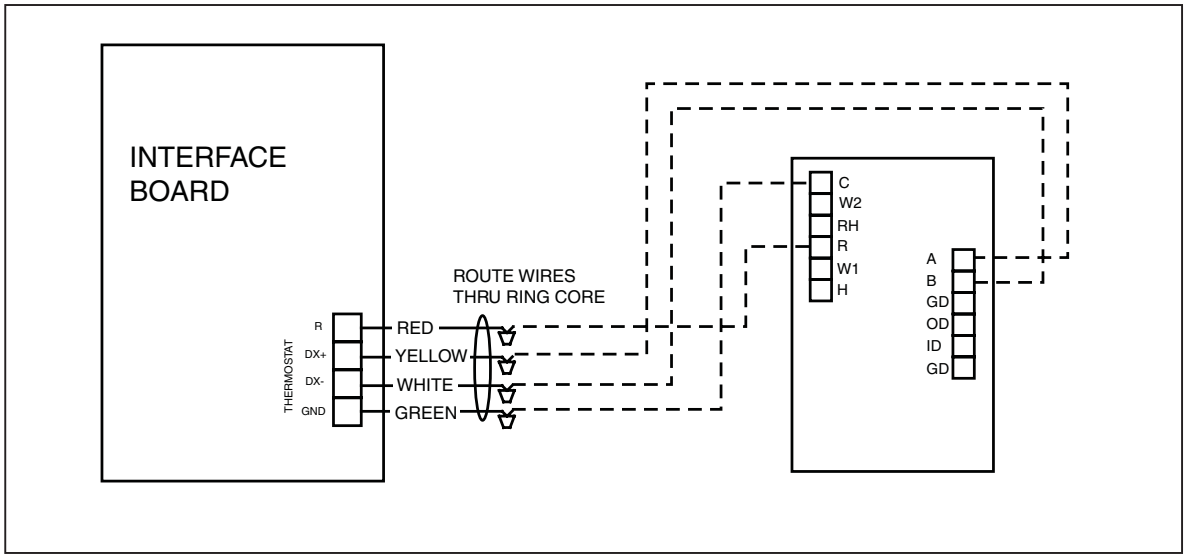


Figure 22. Thermostat wiring in field

Start-up Procedures

After all of the above checks have been made:

1. Close the disconnect(s) to provide line voltage to the furnace.
2. Set thermostat controller using the installer's instructions (also refer to Table 1). Note: Allow thermostat controller to go through fan calibration routine. This will take 60 seconds switch the system mode to heat.
3. Set the thermostat controller above room temperature and verify the operating sequence. (See the **Sequence of Operation)**.
4. After the furnace has run for approximately five minutes, set the thermostat below room temperature and verify steps (8) through (11) of the **Sequence of Operation.**

Verifying and Adjusting Firing Rate

The firing rate must be verified for each installation to prevent over-firing the furnace.

IMPORTANT NOTE:
The firing rate must not exceed the rate shown on the furnace rating plate. At altitudes above 2000 feet it must not exceed that on the rating plate less 4% for each 1000 feet.

Follow the procedure below to determine the firing rate.

1. Shut off all other gas fired appliances.
2. Start the furnace and allow it to run for at least three minutes.
3. Measure the time (in seconds) required for the gas meter to complete one revolution.
4. Convert the time per revolution to cubic feet of gas per hour using Table 11.
5. Multiply the gas flow rate in cubic feet per hour by the heating value of the gas in Btu per cubic foot to obtain the firing rate in Btu per hour. Example:

- Time for 1 revolution of a gas meter with a 1 cubic foot dial = 40 seconds.
- From Table 14 read 90 cubic feet per hour of gas.
- Heating value of the gas (obtained from gas supplier) = 1040 Btu per cubic foot.
- Firing rate = 1040 x 90 = 93,600 Btuh.

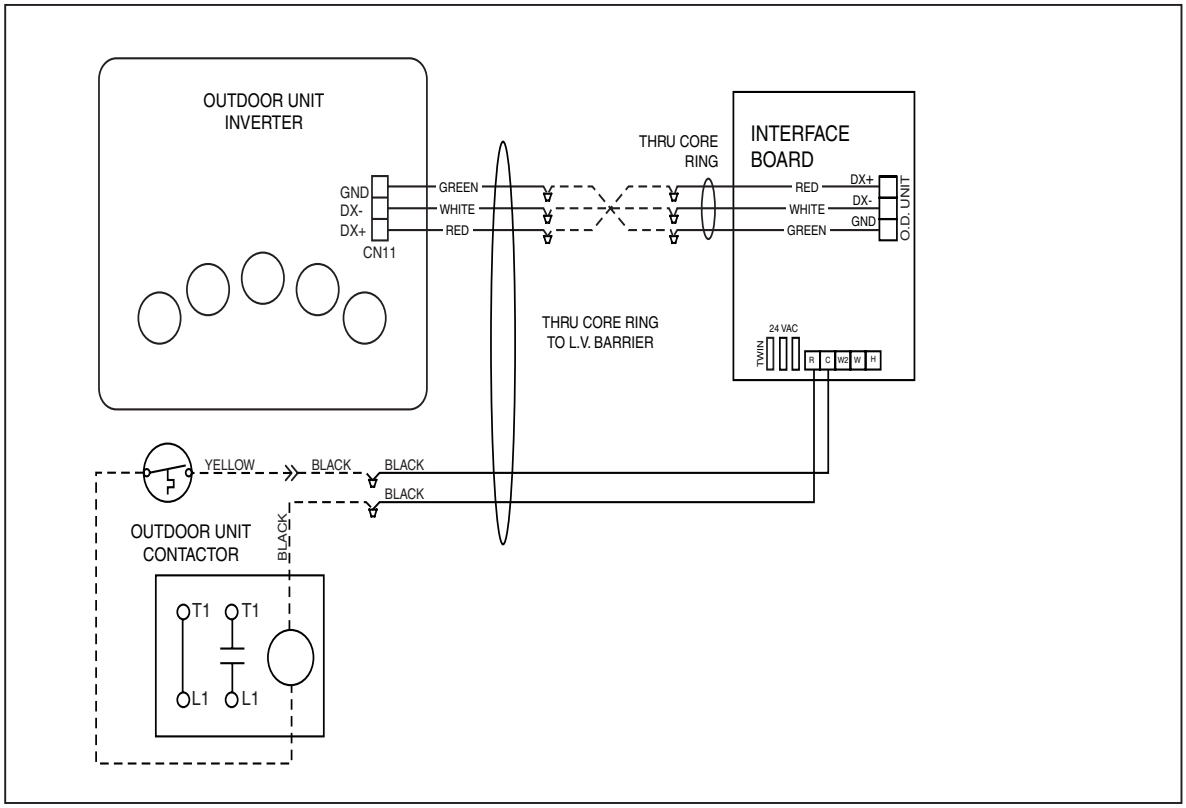


Figure 23. Outdoor cooling unit connection

6. Adjustments to the firing rate can be made by adjusting the gas manifold pressure. See the High Altitude Application section for additional information of firing rate at elevations above 2000 ft.

The manifold pressure for low and high inputs must be set to the appropriate value for installation (see Table 1). Refer to either Table 6 for natural gas or Table 7 for LP/propane gas to verify the manifold pressure setting required for your particular installation. To adjust the manifold pressure, remove the regulator cap and turn the adjusting screw clockwise to increase pressure or counterclockwise to reduce pressure. Note: Check both low and high inputs to the Table 1. Replace the regulator cap after adjustments are complete.

⚠ CAUTION:

Do not re-drill the burner orifices. If the orifice size must be changed, use only new orifices.

⚠ WARNING:

To avoid electric shock, personal injury, or death, disconnect the electric power before performing any maintenance.

Selecting The Cooling Airflow Rate

The thermostat controller communicates with the outdoor unit to determine the proper airflow. The system will operate automatically at the optimum airflow rate for the capacity. Detailed operation is described in the cooling unit installation instructions and control manual.

Verifying and Adjusting Temperature Rise

Verify that the temperature rise through the furnace is within the range specified on the furnace rating plate. Temperature rises outside the specified range could result in premature heat exchanger failure.

GAS FLOW RATE (CUBIC FEET PER HOUR)							
TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF METER			TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF METER		
	1	5	10		1	5	10
24	150	750	1500	74	49	243	486
26	138	692	1385	76	47	237	474
28	129	643	1286	78	46	231	462
30	120	600	1200	80	45	225	450
32	113	563	1125	82	44	220	439
34	106	529	1059	84	43	214	429
36	100	500	1000	86	42	209	419
38	95	474	947	88	41	205	409
40	90	450	900	90	40	200	400
42	86	429	857	92	39	196	391
44	82	409	818	94	38	191	383
46	78	391	783	96	38	188	375
48	75	375	750	98	37	184	367
50	72	360	720	100	36	180	360
52	69	346	692	102	35	176	353
54	67	333	667	104	35	173	346
56	64	321	643	106	34	170	340
58	62	310	621	108	33	167	333
60	60	300	600	110	33	164	327
62	58	290	581	112	32	161	321
64	56	281	563	114	32	158	316
66	55	273	545	116	31	155	310
68	53	265	529	118	31	153	305
70	51	257	514	120	30	150	300
72	50	250	500				

Table 11. Gas Flow Rate

Place temperature measuring device in the return and supply air stream as close to the furnace as possible. The device on the supply air side must be shielded from direct radiation from the heat exchanger to avoid false readings. Adjust all registers and duct dampers to the desired position and run the furnace for fifteen minutes before taking any temperature readings. The temperature rise is the difference between the supply and return air temperatures.

Verifying Burner Operation

To verify operation of the burners, make sure that the blower compartment door is in place and that there is power to the furnace. Set the thermostat above room temperature and observe the ignition sequence. The flame can be observed through the small clear window on the burner box. The flames should be blue, without yellow tips. Flames should extend from each burner without lifting, curling, or floating. After verifying ignition, set the thermostat below room temperature and verify that the burner flame extinguishes completely.

Verifying Operation of the Supply Air Limit Switch

To verify operation of the supply air limit switch, make sure that the blower door is in place and that there is power to the furnace. Completely block the return airflow to the furnace by installing a close-off plate in place of or upstream of the filter(s). Set the thermostat above room temperature and verify that the Sequence of Operation is as described in these instructions. The supply air limit switch should function to turn off the gas valve within approximately five minutes. The circulating air and combustion blowers should continue to run when the supply air limit switch opens. Remove the close-off plate immediately after the supply air limit switch opens. If the furnace operates for more than five minutes with no return air, set the thermostat below room temperature, shut off the power to the furnace, and replace the supply air limit switch.

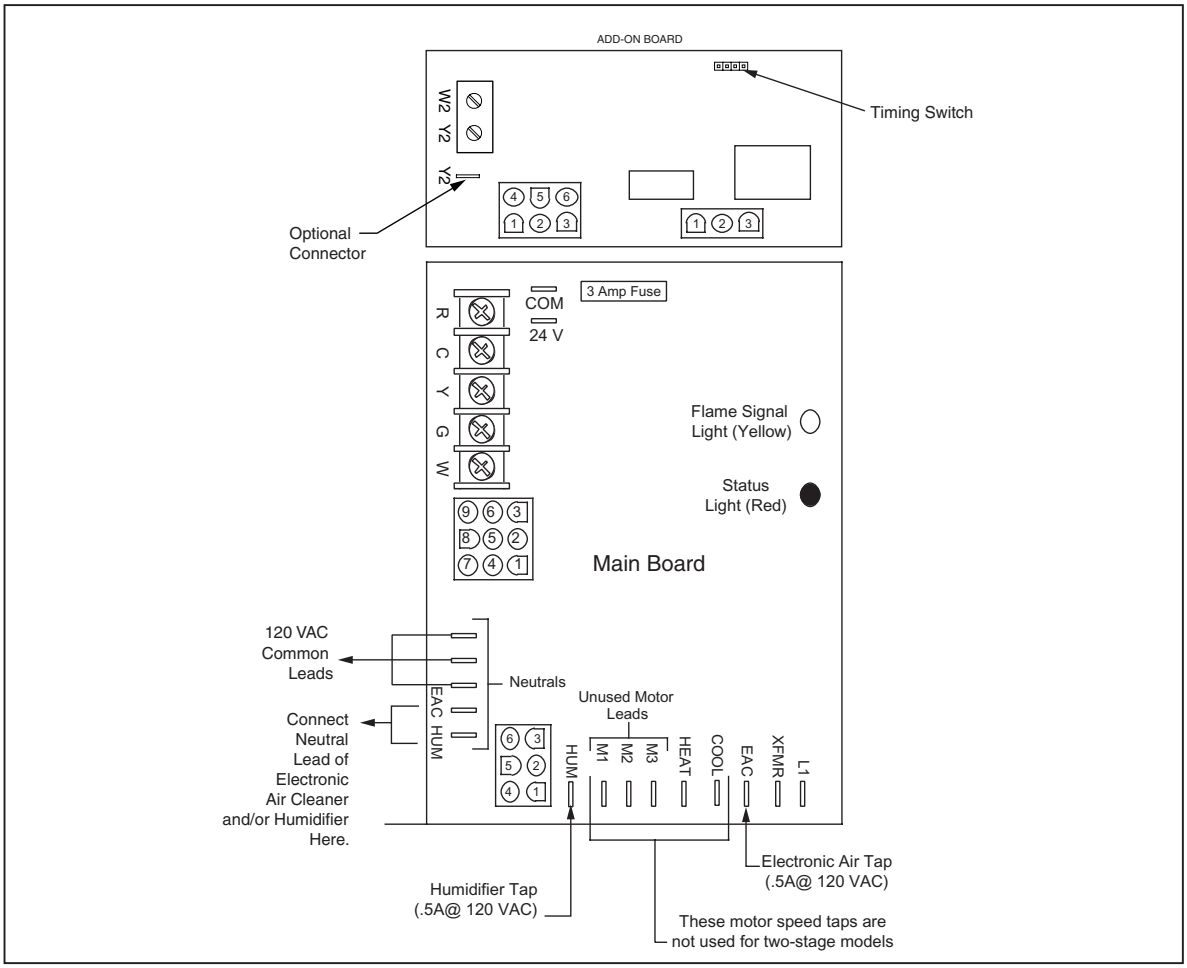
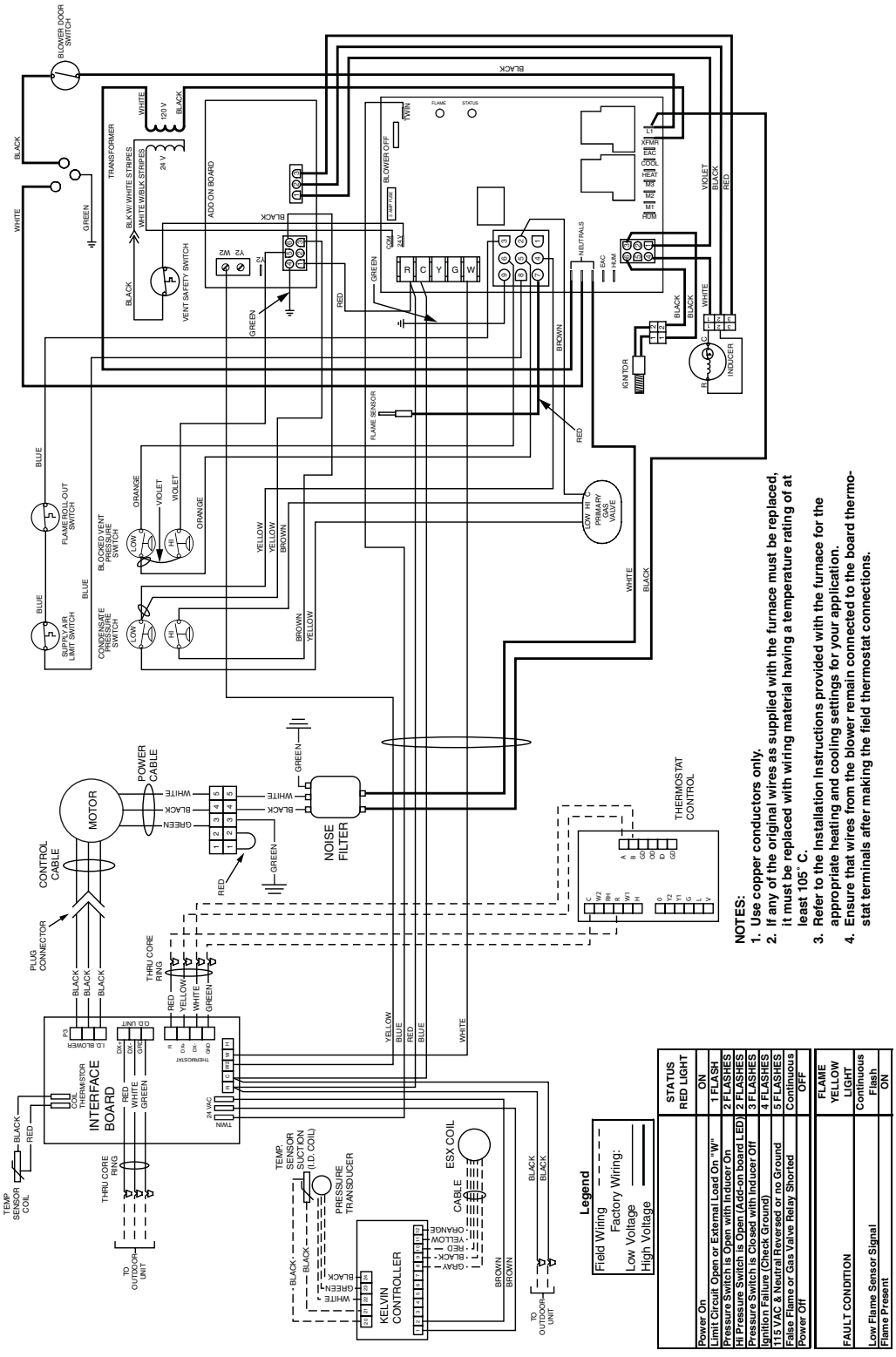


Figure 24. Blower Speed Tap Location

For 95+ 2-Stage iQDrive Model Furnaces (2-Stage Inducer)



NOTES:

1. Use copper conductors only.
2. If any of the original wires as supplied with the furnace must be replaced, it must be replaced with wiring material having a temperature rating of at least 105° C.
3. Refer to the Installation Instructions provided with the furnace for the appropriate heating and cooling settings for your application.
4. Ensure that wires from the blower remain connected to the board thermostat terminals after making the field thermostat connections.

STATUS RED LIGHT	
Power On	ON
Limit Circuit Open or External Load On "W"	1 FLASH
Pressure Switch is Open with Inducer On	2 FLASHES
Hi Pressure Switch is Open (Add-on board LED)	2 FLASHES
Pressure Switch is Closed with Inducer Off	3 FLASHES
Ignition Failure (Check Ground)	4 FLASHES
115 VAC & Neutral Reversed or no Ground	5 FLASHES
False Flame or Gas Valve Relay Shorted	Continuous
Power Off	OFF

FAULT CONDITION	FLAME YELLOW LIGHT
Low Flame Sensor Signal	Continuous
Flame Present	ON

WD# 7106440

Figure 25. Wiring Diagram

DESCRIPTION OF COMPONENTS

Figure 26 shows the location of each of the functional components described below. If any component of the furnace must be replaced, use only factory authorized replacement parts. See the Replacement Parts List for each component.

Flame Sensor – The flame sensor acts to prove that flame has carried over from the igniter to the opposite end burner. If no flame is sensed, the furnace will be shut down automatically.

Primary Gas Valve – The gas valve controls the flow of gas to all of the burners. When the gas valve is energized it automatically opens and regulates the gas pressure in the manifold.

Secondary Gas Valve – The gas valve controls the flow of gas to the high fire burners only.

Pressure Switch – The pressure switch verifies that the inducer is drawing the combustion gases through the heat exchanger. It also senses a blocked condensate drain condition.

Vent Pressure Switch – The vent pressure switch reacts to blockage in the vent or combustion air piping.

Supply Air Limit Switch – The supply air limit switch prevents the air temperature leaving the furnace from exceeding the maximum outlet air temperature.

Vent Safety Switch – The vent safety switch shuts the furnace down if the outlet flue gas temperature increases above 160°F. This switch protects the plastic flue system and the inducer from over-temperature conditions.

Flame Roll-Out Switch – This switch provides flame roll-out protection to the furnace and combustion air inlet pipe.

MAINTENANCE

It is recommended that the furnace be checked yearly. At a minimum, this check should include the following items.

⚠ WARNING:

To avoid electric shock, personal injury, or death, disconnect the electric power before performing any maintenance.

⚠ WARNING:

Holes in the vent pipe or heat exchanger can cause products of combustion to enter the home. Replace the vent pipe or heat exchanger if leaks are found. Failure to prevent products of combustion from being circulated into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

Combustion Air and Vent System

Check the combustion air and vent pipe to ensure that it is not damaged, corroded or blocked by debris. Any damaged section of vent pipe must be replaced, and any obstruction or blockage must be removed prior to operating the furnace.

Air Filter(s)

⚠ WARNING:

Never operate the furnace without a filter in place. Dust and lint in the return air can build up on internal components, resulting in loss of efficiency, equipment damage, and possible fire.

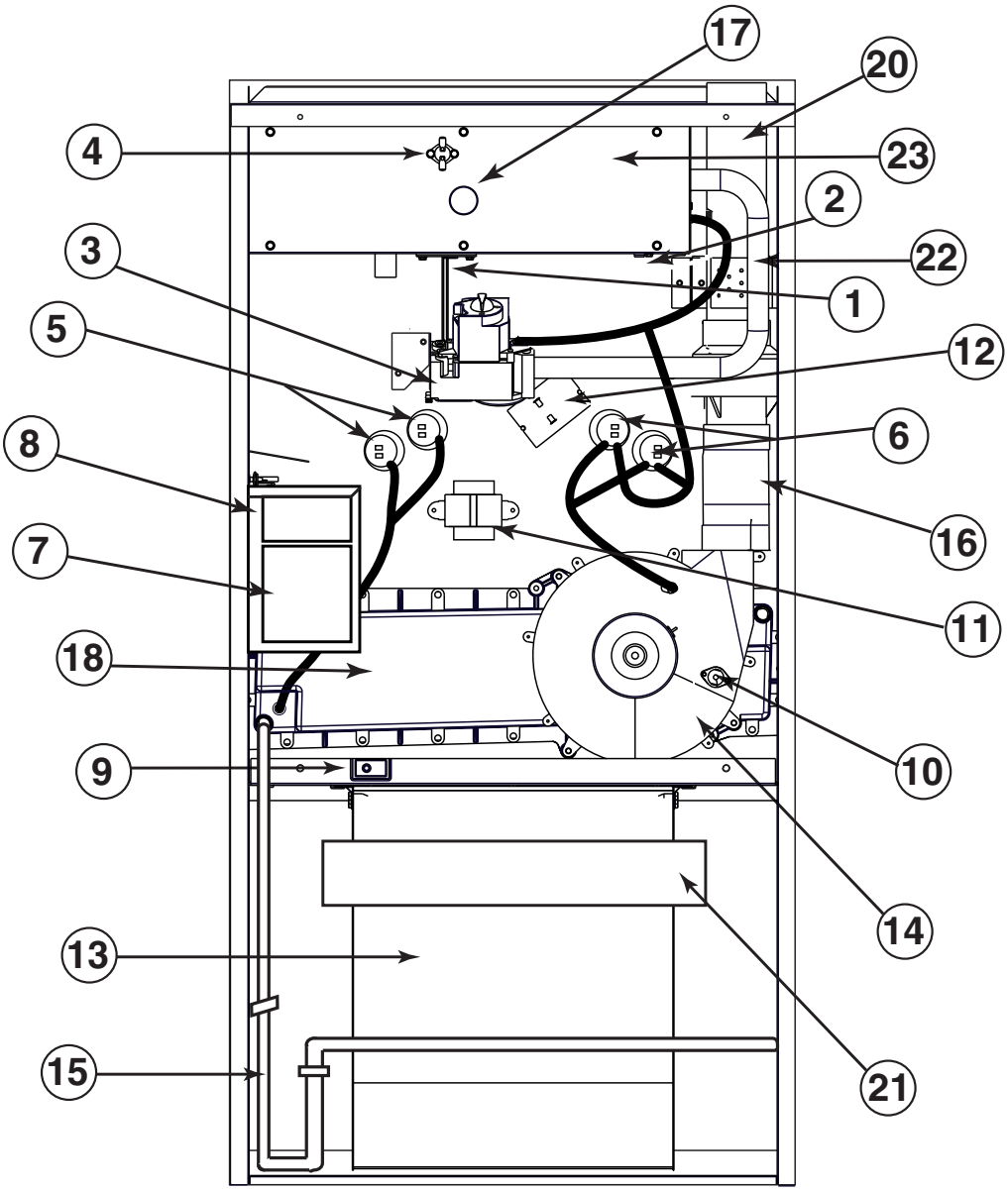
Air filter(s) are not supplied with the furnace as shipped from the factory. Filters for side return and bottom return applications are available from your local distributor.

The installer should provide a filter rack for a high velocity type filter in the return air duct adjacent to the furnace. Filters should be changed or cleaned monthly during the heating season. New or newly renovated homes may require more frequent changing until the construction dust has been removed.

Lubrication

The bearings in the circulating air blower motors are pre-lubricated and sealed at the factory. No further oiling of the bearings is required for the life of the motor.

Upflow/Horizontal Furnace Models



1 Igniter (Not Shown)
2 Flame Sensor (Not Shown)
3 Gas Valve
4 Flame Roll-out Switch(s)
5 Condensate Pressure Switch
6 Pressure Switch
7 Control Board
8 Add On Board
9 Blower Door Switch
10 Vent Safety Switch
11 Low Voltage Transformer
12 Supply Air Limit Switch
13 Circulating Air Blower Assembly-
14 Induced Draft Blower
15 Condensate Drain Tube (Not Shown)
16 In-Line Drain Assembly
17 Burner View Port
18 Front Header Box
19 Combustion Air Intake (Not Shown)
20 Exhaust Vent
21 Variable Speed Blower Kit
22 Gas Manifold Assembly
23 Burner Box Assembly

Figure 26. Location of Major Components

Condensate Drain Assembly
Be sure the condensate lines are free and open (i.e. avoid kinking hoses). Also make sure all hose clamps are tight to avoid drawing air into the system.

Blower Compartment
The blower compartment should be cleaned monthly during the heating and cooling seasons to remove any dirt and lint that may have accumulated in the compartment or on the blower and motor. Dirt and lint can create excessive loads on the motor resulting in higher than normal operating temperatures and shortened service life.

Heat Exchanger and Burner Maintenance
The furnace should operate for many years without excessive soot buildup in the flue passageways, however, the flue passageways, the vent system, and the burners should be inspected and cleaned (if required) by a qualified serviceman annually to ensure continued safe operation. Particular attention must be given to identify deterioration from corrosion or other sources.

SYSTEM OPERATION INFORMATION

Proper maintenance is most important to achieve the best performance from a furnace. Follow these instructions for years of safe, trouble free operation.

- **Do not place combustible materials on or against the furnace cabinet or the vent pipe.**
- **Do not store gasoline or any other flammable vapors and liquids in the vicinity of the furnace.**
- **Change or replace the air filters monthly during any period when the circulating blower is operating regularly.**
- **Always replace the doors on the furnace after servicing. Do not operate the furnace without all doors and covers in place.**
- **Avoid operating the furnace when windows and doors are open.**
- **Be sure that the thermostat is properly installed and is not being affected by drafts or heat from lamps or other appliances.**

Sequence of Operation

The operating sequences for the heating, cooling, and fan modes are described below. Refer to the field and furnace wiring diagrams; Figures 22 and 25.

Heating Mode:

1. On a call for heat, the thermostat sends signal to the interface control applying 24 VAC to the interface board.
2. The control board checks for continuity on the 24 VAC limit control circuit (over-temperature limit switch, flame rollout switches and blocked vent switch in series). If an open limit is detected the control board will energize the inducer blower. All other system functions will be inoperable until the limit circuit closes. While the limit is open, the bottom red LED will pulse at a rate of 1 blink per unit time.
3. The furnace control checks for continuity across the pressure switch (24 VAC). If the pressure switch is closed the heat mode sequence will not continue. If it remains closed for 10 seconds the red LED will blink 3 times repetitively until the fault condition clears. Note: Red LED light on the add-on board will flash if vent high set pressure switch opens. Both red LEDs will flash if lower set pressure switch opens also. If it closes, red LED on both the boards will reset automatically one hour later.
4. The inducer is energized.
5. The pressure switches for both high and low stages will close. If the pressure switches do not close after 10 seconds the fault LED will blink 2 times repetitively and inducer will continue to run until the switches are closed. Note: If the low stage pressure switch closes only, and T-Stat call for 2nd stage, red LED on the add-on board will flash for an hour.
6. The inducer will pre-purge for 30 seconds at high speed and reduce to low speed. The igniter will start its warm up as follows:

   Initial Power up: After 30 seconds of igniter warm-up the gas valve (24 VAC) will then open. The igniter circuit will stay energized for 3 seconds after the gas valve opens.

   After Initial Power up: The control has a programmed adaptive ignition feature which varies the warm-up period as follows: If

ignition is successful the warm-up is *reduced* by 3-seconds on each subsequent call for heat until ignition failure occurs. Upon ignition failure, the warm-up is *increased* by 3-seconds on the next try. If successful, the timing remains fixed at this level. In general, whenever ignition failure occurs the warm-up interval is increased by 3-seconds on the next try. And if successful, it remains there. Minimum and maximum warm-up time limits are set at 6 and 54 seconds, respectively.

7. The furnace control must prove flame via the flame sensor 5 seconds after the gas valve opens. If flame is sensed, all burners are on and the igniter cools off. If no flame is sensed, the gas valve closes immediately and the inducer continues to run. A second trial for ignition (step 6) begins if no flame is sensed on the fifth try for ignition, the furnace control is locked and the red LED will blink 4 times repetitively. The thermostat must be off for at least ten seconds to reset the furnace control after a lock out. Otherwise, the furnace will attempt another ignition sequence in 1 hour.
8. The thermostat sends a signal to the interface control to operate the blower at selected speed.
9. When the thermostat controller has been satisfied, high fire of the gas valve is de-energized and then operates back at low fire. Main blower stages to lower speed. Low fire is satisfied, the low fire will be de-energized.
10. The inducer is de-energized after a 30 second postpurge.
11. The circulating air blower remains on for 120 seconds.
12. Abnormal conditions: If a limit opens during operation, the inducer blower continues to operate. The gas valve is de-energized immediately. The inducer blower continues to operate until the limit closes, then is de-energized.

Cooling Mode:

1. On a call for cooling the thermostat sends a signal to the interface control to operate the blower and outdoor unit.
2. The circulation blower will then ramp to the selected airflow.
3. The system will modulate capacity and airflow rate to match the load requirements. If the temperature falls below the set point, the control will shut the system off.

Fan Mode:

1. On a call for fan operation, the thermostat sends a continuous on signal to the blower.
2. The circulating air blower ramps to the programmed airflow rate for the FAN ON mode.

Furnace Fails to Operate

If the furnace does not operate check the following:

1. Is the thermostat operating properly?
2. Are the blower compartment door(s) in place?
3. Is the furnace disconnect closed?
4. Has the circuit breaker tripped or the control board fuse burned open?
5. Is the gas turned on?
6. Are any manual reset switches open?
7. Is the filter dirty or plugged?
8. Is the flame sensor coated? (Remove and clean with emery cloth.)

If the furnace locks out after 5 attempts for ignition, it will try again every hour if a call for heat remains.

INSTALLATION/PERFORMANCE CHECK LIST

LOCATION _____ CITY _____ STATE _____

INSTALLER _____ CITY _____ STATE _____

UNIT MODEL # _____ UNIT SERIAL # _____

Minimum Clearances per Table 3? _____

Electrical Connections tight? _____

Line Voltage Polarity correct? _____

Supply Voltage: _____ Volts

Blower Motor HP: _____

FUEL TYPE:

Natural Gas _____ LP/Propane _____

Gas Piping Connections leak-tested? _____

Gas Line Pressure: _____
(in. water column, with furnace operating)

Manifold Pressure: _____
(in. water column, with furnace operating)

Is there adequate fresh air supply for combustion and ventilation? _____

Furnace Input: _____ (Btuh)

Supply Air Temperature: _____ (° F)

Return Air Temperature: _____ (° F)

Temperature Rise: _____ (° F)

Are Flue Connections tight? _____

Is there Proper Draft? _____

Is Vent free from restrictions? _____

Is the Filter(s) secured in place? _____

Is the Filter(s) clean? _____

Has the Thermostat been calibrated? _____

Is the Thermostat level? _____

Is the Heat Anticipator Setting correct? ____

Has the Owner's Information been reviewed with the home-owner? _____

Has the Literature Package been left near the furnace? _____

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